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# THE COAST ARTILLERY JOURNAL

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## Combat Methods of the Japanese\*

By COLONEL C. E. KILBOURNE, C. A. C.

TO THOSE who would appreciate the basic causes of the success or the failure of a campaign no royal road can be pointed out. The study of a nation's doctrines of war, of her field service and drill regulations is valuable but not conclusive. If accepted at face value these may lead to erroneous conclusions, that, in turn might lead to erroneous action on the battlefield. Two nations may announce the offensive, the objective and cooperation as being the principles most important to insure success of an engagement, but their interpretation of these terms may be quite different. Again, two nations may state that the Infantry is the primary arm, one expecting to attack with the bayonet under cover of such artillery support as may be obtainable, the other expecting to shatter the enemy with artillery fire, using the Infantry to mop up and occupy the position so gained.

The relation between distinctive combat methods and announced doctrines can be learned only by a detailed study of campaigns in which the student is willing to examine all orders and decisions and to trace the effect of these down to the smallest unit. This will frequently indicate the persistence of certain methods and principles in spite of character of terrain, of development in mechanical means of warfare and of enemy reaction. It is on such a detailed study that the following notes on the Japanese army are based. Doubtless selected instances may appear to contradict conclusions drawn, but it is believed the impressions conveyed are, on the whole, reliable.

As to organization we know the larger features but are in doubt as to details. The Japanese endeavor to keep their organization secret and questions are met with polite evasion. The following, therefore, is not to be taken as absolutely accurate.

The Japanese discard the army corps, building the field army direct from divisions. As with us, the G. H. Q. directs the armies, and, in the Russo-Japanese War, continued this direction success-

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fully with a number of armies our present doctrine would lead us to believe so great as to demand the formation of army groups. Their average of three divisions to an army gives the field army approximately the numerical strength of our typical army corps, but it is, in conception, and by the permanent assignment of army troops, essentially an echelon for independent operations.

The Japanese division differs from that of any other great power. Retaining the square formation—two brigades each of two regiments—for the Infantry, their artillery consists of a single regiment of three battalions. In rifle (bayonet) power it is the strongest of all; in artillery and automatic fire the weakest. A regiment of cavalry, of about the strength of our squadron, is assigned. There is no organic air service. The division is complete as to engineers, communication troops and trains. Numerically it is something less than 85 per cent of our war strength division.

During the Russo-Japanese War independent Infantry brigades, some of Infantry only, others “reinforced,” were used as army troops and G. H. Q. reserves. They were assigned to armies and withdrawn in accordance with the mission and situation, just as we assign and withdraw G. H. Q. artillery. They were used to enable army commanders to hold out a cohesive reserve and without necessity for disrupting any division. They could replace a brigade that had been exceptionally heavily engaged thus enabling the division to continue its effort. They were used on missions not demanding a complete division, and could make progress (living mainly on the country) in terrain where supply difficulties would tend to immobilize a complete division. For flank protection, for lines of communication, and for many duties requiring the detachment of small forces they saved calls on the divisions, leaving these, and the armies of which they were component parts undisturbed as to normal organization and combat capacity.

They were not “provisional” brigades, but were duly organized from the beginning with permanent commanders and staffs. They had a distinct organizational *esprit*; many will live in history.

Apparently these units have disappeared. They were known as “kobi” brigades, being organized from kobi (first reserve) troops and at present we hear only of “kobi” divisions. The writer believes that independent Infantry brigades will reappear as G. H. Q. reserves in another war. They proved their value too conclusively to have been discarded. Sustaining this belief is the fact that, in Japanese maneuvers, are found independent Infantry units (regiments) in reserve; also it has been noted, in conversation with Japanese officers, that there is a distinct reaction when the operations of the kobi brigades is discussed.

A consideration of the foregoing indicates that the Japanese are not imitators of the organization of any European nation, just as a study of their operations will show that they are far from following blindly the doctrines and methods of any nation in campaign and combat. There seems no doubt that they have studied all and given all due weight, but that organization, strategy and tactics are distinctly their own.

Comment is made from time to time that the Japanese are conservative and slow to change. Their history is contradictory in this. Certainly no nation stood still for so long a period as did Japan under the Shogunate of the Tokugawas. On the other hand they changed from a feudal to a modern state in a generation, their military system keeping pace. They have been criticized for "failing to profit by the lessons of the World War," the relatively small artillery strength, the small percentage of automatic weapons and the practical absence of motor transport being cited. But their attention to air development and the submarine, considered in connection with their past record for careful planning, leads to the logical conclusion that they have not only studied the World War but have applied the lessons to be learned therefrom to their own problems and with the characteristics of the area they wish to control prominently in mind. We should remember that Grant sent the bulk of his army artillery to the base in the campaign of 1864. He could not bring it into action nor supply it. It is probable that Japan has designed her organization for a special theatre, and to bring into action the maximum force, all things considered, in that theatre. Tables of organization do not win battles.

As to leadership the number of armies controlled successfully from a single headquarters direct has already been commented on. The success of this control appears to have been due to the thorough understanding by all commanders of the objective, to complete instruction of each in the mission of the others, to the maximum of personal consultation of commanders during the engagements, and to the use of cavalry for liaison purposes. Among army commanders there was absolute loyalty to the objective, combined with initiative. There are instances where commanders, anticipating the desires of the supreme command, prepared the orders for the next movement of their own troops, and, when the directive was received from General Headquarters, were able to issue the orders so prepared with little or no alteration.

Cooperation among commanders was a matter of course. We find army commanders, without orders or request, voluntarily detaching a brigade to assist another army, possibly thirty miles away. We find regimental commanders (themselves engaged) send-

ing a battalion to the aid of another unit they believed more heavily pressed. Again and again, when information was received that a certain organization had been repulsed or was being counter-attacked, we find contiguous units attacking on their own initiative, or reserves deflected from a local mission to some operation that would tend to relieve the pressure on the threatened unit.

Confidence in commanders seemed to be ingrained, due probably to thorough training and to the loyalty referred to. We are taught that, in a field order, no alternative is admissible; in the Japanese orders such directives as "will *endeavor* to capture," "will occupy —, if *possible*," were habitually to be found. It was assumed that commanders would do their utmost. As a corollary we find commanders perfectly frank in expressing doubts of success. Again and again division and brigade commanders reported that they could not carry objectives assigned, and, occasionally, that they doubted their ability to resist counter-attack. And this without apparent fear of reproach or punishment. Higher commanders responded to such reports by sending reserves if any were available, or by directing that ground gained should be held to the last man, or that the attack must be continued at all hazards. The writer has found record of only one general officer being relieved from command; there was no Limoge or Blois.

Just as there appears to have been no fear of punishment in event of failure, there seemed no thought of self-advancement and no jealousy. In the Russo-Japanese War there were no indications of indecision, and none of hasty, ill-thought-out action. Calm and deliberate planning, combined with energetic execution seems to have been the rule. And an enormous capacity for personal exertion, continued with practically no intervals for sleep, was notable for division and brigade commanders.

Much has been written of the Japanese soldier, of his courage and endurance. Certainly the assaults at Port Arthur equal any in history for daring and determination. The operations of the 12th Brigade, 12th Division at the Sha-ho set a standard of endurance. This unit fought all day October 11; assaulted and captured Sanchengtzu hills the night of the 11th-12th, carried the ridge to the north on the 12th, crossing a valley 600 yards broad in three rushes; were reorganized for another attack when recalled for a new mission; marched ten miles through a heavy rain storm the night of the 12th-13th; attacked a Russian force on the hills guarding a pass the following morning making several unsuccessful assaults;

reformed to resist attack on the approach of reinforcements to the Russians; took up the pursuit when the enemy began retiring on the 14th; then marched 18 miles over mountain trails to rejoin the division on the 15th.

While the Japanese were pioneers in application of modern methods of massed artillery fire, concealment and indirect fire, there were instances to show that the same aggressive spirit shown by the Infantry actuated also officers and men of the artillery. Their artillery was outranged, but they pushed it forward and generally succeeded in besting the superior artillery of their opponents. The initiative of a junior officer in bringing his mountain guns into an advanced position enfilading Gershelmann's line contributed greatly to the success of Kuroki's first day's operations at Liao Yang.

On the other hand, there are plenty of instances of Japanese soldiers being stopped by accurate fire, and a few of their failing to respond to their officers' call for an advance. And, as the war progressed, the instances of reckless daring in mass diminished. They are admirable soldiers, will attack with zest and resist to the end; they are cheerful under hardships; they have great endurance. But it is not believed that they differ from soldiers of other races who have enthusiasm for the cause and confidence in their leaders, and they have produced no army of higher spirit or greater endurance than the American army that marched to the Rhine.

A picture has been drawn of skillful, aggressive and unselfish leadership and of loyal response from the troops that is believed justified by the facts of history. But while these traits, combined with the absence of organization and consistent leadership of their opponents, gave them an unbroken series of victories in the last war, an analysis of their methods seems to indicate that the same careful staff work and an equal fixity of purpose on the other side might have reversed the results.

Oyama may have been influenced but certainly was not dominated by the doctrines and maxims of other leaders. He did not hesitate to plan and execute a strategic concentration upon the selected battlefield under conditions that made it certain his plan would become known. His plan yielded to the enemy the advantages of interior lines, with far better means of supply and movement. By all rules his armies should have been beaten in detail long before they could effect their concentration facing Liao Yang. Not one of them but was immobilized from time to time by supply difficulties, while the railroad and better roads left the Russians free to move.

In the larger engagements we find conclusive evidence of planning the action in detail, and depending upon the success of each step contributory to the final object. Instances multiplied where a

perfectly logical reaction on the part of the Russians would have forced a complete change of the rather complicated plan and with grave danger of disaster.

The double envelopment has been condemned for the smaller force. Oyama did not hesitate to use it, and it is to be seen also in some of the independent operations of Kuroki.

All great leaders have stressed the importance of saving reserves until the crisis of the action. We find, not only Oyama, but all of the subordinate commanders committing reserves very early in an engagement, invariably before the outcome could be foretold and frequently in the first contact of the main forces. In all of the larger battles there were periods when the Japanese had put in practically every unit, and in all (except the Sha-Ho) they were over-extended at the same time, while the Russians still had large (though rather disorganized) reserves of fresh troops.

We are told that the greatest effort is to be made in the decisive direction and area—this maxim had, apparently, no weight with Oyama. At Liao Yang and to a lesser degree at Mukden he concentrated his mass in a portion of the field where no decision could be expected logically, where no great result could come from success, depending upon comparatively small forces to influence the retreat of the enemy; forces so distant as to be almost beyond his immediate control.

On the other hand, he followed the maxim about adherence to a plan once adopted. None of his subordinate commanders received contradictory orders, none was embarrassed by sudden changes, none was left in doubt, none left idle. In his brief written orders, regardless of success or failure in attaining the day's objectives, and regardless of what the enemy might be attempting, the following phrase is generally to be found: "The intentions of the Commander-in-Chief are unchanged."

Neither he, nor his army commanders, would ever yield the initiative. Should the enemy develop great strength and aggressiveness in one portion of the field, even though success might have serious results, the action was always to expedite, and (if reserves were available) to strengthen the attack *elsewhere*.

Oyama opened neither of his main offensive battles in the direction he expected to obtain a decision. In both he developed an attack of sufficient strength to appear serious on the opposite flank and continued it until it was apparent that his opponent had committed many of his reserves. Then came the decisive movement, a wide turning or a double envelopment, unless he decided upon an intermediate stage consisting of a holding attack in the center with light, extended forces. Both at Liao Yang and Mukden a well plan-



ned counter-attack through the center would have separated the Japanese forces and cut off supplies from at least one wing.

Only rarely was the Japanese attack as strong as it seemed; the enemy, not unnaturally, could not credit the fact that, in the opening of a long engagement, their enemy would commit practically all reserves to the line. They could not believe that Kuroki (at Liao Yang) isolated on the north of the Tait-zu, would extend four brigades over a ten-mile front in the endeavor to outflank and threaten the retreat of superior forces then vigorously counter-attacking him in a direction where failure to hold would cut him off from hope of reinforcement. Almost invariably the Russians exaggerated the strength of the forces along the entire line, whereas the simplest staff work should have shown them the true condition.

In the lesser battles the same strategic and tactical conception is to be observed. In only one of the engagements (Tashihchiao) was a frontal attack depended upon for a decision. In all others the frontal attack held attention while a large portion, if not the bulk, of the forces were sent on wide turning movements or (Motienling) a double envelopment. Even in the smaller affairs (see Chiao-Tou) this method was habitual. A counter-attack delivered from four to six hours after the first advance of the Japanese would frequently have found only a small force in front and covering the line of communications. The remaining forces were generally scattered in small detachments with poor means of communication and such supplies as could be packed over inferior trails.

Another noteworthy characteristic was the night movement and attack, especially in terrain where artillery support could not be assured. The night attack, also, almost invariably followed failure of the day assault, *provided success at that point was essential to the plan*. Oyama's evening orders frequently contained the directive "*Such unit will endeavor to carry — tonight.*" Had the Russians after repelling a day attack, assembled and disposed reserves to meet a night attack they would have saved many a key point. And, in those cases where the night attack did not follow, had they utilized the reserves so assembled for a determined advance the following morning they would have found, almost invariably, only a shell in front; that the bulk of the forces that had attacked the day before had been withdrawn for use elsewhere.

There is no doubt that this shell would have fought bitterly. It is to be noted that when the Japanese Infantry retired, they did so on a position that was marked to be held, that where the position occupied was really important *they did not retire*. One company held against a battalion at Motienling, and, near Chiao-Tou, a single company fought against eight, and, strengthened by the arrival of

two more companies, fought for four and a half hours until relieved. A larger example is that of the 12th Brigade and Guard Kobi Brigade at the Sha-Ho, opposing the 1st and 3rd Siberian Corps, reinforced by the cavalry of *Rennenkampf* and *Samsonoff*. Frequently the Russians had the *force* to overwhelm them—but lacked the staff to analyze their enemy's combat methods.

Considering the character of the terrain and the scarcity of telephone communication, the liaison was remarkable. It is astonishing to see how promptly Oyama gathered information of events, and how quickly reaction in one portion of the line followed success, failure, or threatened reverse in another. Doubtless another war will find far more extensive use of electrical communications, and it may well be that the Japanese cavalry will gain in prestige by those brilliant surprise actions we expect of that arm in open warfare. But we should not criticize success, and the Japanese cavalry did their full share in the success of these battles; incidentally its use tends to confirm the view that the Japanese are not tied down by prevailing ideas; that they prepare what they need and use it as they deem most advisable. As noted they still have a considerable cavalry detachment with the division.

It has been frequently remarked that in no battle did the Japanese exploit their success, that invariably the Russians made good their retirement, and that only at Mukden was the retirement seriously threatened; in brief, that the Japanese were capable of any exertion up to the time the full fruits of victory were to be gathered, then failed of the final effort. Our principle of the objective—the destruction of the enemy armed forces—was not followed out. The Clausewitz doctrine—that the army which inflicts the greatest losses really wins regardless of who holds the battlefield and provided both are left intact to fight again—was equally discarded. The Japanese were satisfied with actual mastery of the battlefield.

History may show a possible explanation of this. There is no recorded instance of a Japanese army losing a battle to a foreign enemy. Minor reverses, yes, as witness the capture of Tsushima by the Koreans; the abandonment of a campaign, yes, as witness the many failures to hold Korea; yielding the fruits of victory, yes, as witness the retirement from Port Arthur and the Liao Tung after the Chino-Japanese War, on demand of the European powers; but a pitched battle of opposing forces—never. Japanese troops have fled in panic, but it was in civil wars when their opponents were also Japanese.

This tradition of invincibility when facing a foreign foe may be the explanation of the failure of the Japanese to exploit their victories in the Russo-Japanese War. It would be a very unusual

man who would risk being the first soldier of his race to lose a battle to a foreign army. Only in some of the smaller engagements were the Russians decisively defeated; in most of the battles they retired from the field when there was still plenty of fight left in the men. If cornered, they might turn the tables; once they were definitely known to be retiring they were permitted to do so.

In this record of unbroken victories there is an element of weakness as well as of strength. While it undoubtedly enhances the morale of all ranks, it may explain the grave risks taken and the heavy losses accepted, sometimes without justification, considering the benefits, in order to ensure the actual occupation of the disputed field, and it may explain, as intimated above, why the final effort was not made. The plea of exhaustion cannot be accepted; *all* Japanese units had not made such efforts as that described for Matsunaga's brigade at the Sha-Ho. There was some other reason.

It may be that Oyama realized that he could not afford to lose a battle on account of the effect upon Japanese prestige. Japan depended upon loans to finance the war. Continuous success meant continued confidence, while a reverse might tighten the purse strings of Europe. This might have been the reason for resting satisfied with the appearance of victory rather than risking all to attain the reality; all well-knowing that no complete analysis could be made till after the war. The history of the Japanese move for peace, and the reasons that government took the initiative in seeking peace, tend to confirm this view. To have followed the directive from the homeland, rather than to follow his own instincts as a general, is not beyond what is known of Oyama's character and that of his army commanders.

To sum up:

The Japanese Infantryman is an ardent fighter with preference for the bayonet. He is capable of prolonged exertion, of extremely long charges and he will not yield ground he is ordered to hold;

The artillery is well trained and will take great risks to support the Infantry;

The cavalry does not attempt the rôle we deem basic—its most valuable function is contact and liaison;

The organization is built to enable the maximum strength, all things considered, to be developed in a terrain of inferior communications.

Their leaders are skillful, tireless, calm, and daring. Personal ambition seems lost in devotion to the general success;

Night movement and night combat are habitual;

There is a singular uniformity of maneuver, and of reaction in case of success or failure;

There is a tendency to complicated plans capable of disruption if opponents combine energetic leadership with skillful staff work;

There is great determination in adhering to a plan and thorough mutual confidence among leaders;

They will not yield the initiative regardless of danger at critical points;

Small reserves and early commitment of these is the rule;

They will risk anything, will drive their men to the limit and accept any losses rather than yield a battlefield; but will take no chance of forcing a counter-attack once the enemy definitely breaks off action and retires;

They are careful and analytical students of the doctrines, methods, organization and equipment of others, but accept and use only those that seem best fitted to their own problems.

#### A TOAST

Here's to the Blue of the wind-swept North  
When we meet on the Fields of France,  
May the spirit of Grant be with you all  
As the sons of the North Advance!

\* \* \* \*

Here's to the Gray of the sun-kissed South  
When we meet on the Fields of France,  
May the spirit of Lee be with you all  
As the sons of the South advance!

\* \* \* \*

And here's to the Blue and the Gray as One!  
When we meet on the Fields of France,  
May the spirit of God be with us all  
As the sons of the Flag advance!

—George Morrow Mayo.

# Relations of Land Power and Sea Power

By COLONEL S. C. VESTAL, C. A. C.

EDITOR'S NOTE: *Colonel Vestal considers this subject under two hypotheses: the first where the superior land power is inferior on the sea; and the second, where the superior land power is superior on the sea. The first of these hypotheses was published in the May issue of the JOURNAL, the second follows.*

AT THE beginning of Roman history, which for our purposes we may take as the year 509 B. C., Rome was one of a large number of Italian city states. Her territories scarcely extended beyond the walls of the city. She was governed by two consuls, elected annually by the freeholders, a senate of 300 life members, and an assembly of the people. The right to serve in the army and to vote at elections was limited to freeholders. To increase the number of her forces it was necessary for Rome to increase the number of her land owners.

Roman magistrates were elected by the popular vote of all Roman citizens who were present in the city on election day. Rome was lavish in conferring citizenship upon her provincials; but as the privilege of voting could only be exercised by the presence of the voters in the city, the power of the state ultimately fell into the hands of professional voters who lived in Rome upon doles furnished by the government.

Every Roman magistrate was a soldier and exercised active command by virtue of his civil office. Rome selected men for high command by electing her favorite soldiers to high civil office. Contrary to what one might expect from the writings of modern publicists, the effect of the military education of Roman statesmen, was to make her foreign policy extremely conservative and non-aggressive.

The Senate consisted of all who had filled or were filling certain high civil offices and of additional members necessary to make up the legal number, selected from the lower magistracy by a censor chosen every fifth year by the people. If the President, the Cabinet, and the Supreme Court of the United States were selected annually by popular vote, if all who were elected to these high offices passed automatically for life into the Senate, we would have a body somewhat analogous to the Roman Senate. If we could imagine an august

assembly of elder statesmen, soldiers, and sailors which should contain Mr. Taft, Elihu Root, Joseph G. Cannon, John J. Pershing, William S. Sims, Robert L. Bullard, Charles P. Summerall, John L. Hines, William S. Benson, and Hugh Rodman; if moreover, each of these individuals had filled high civil office, had served when young as officers in the army or navy and had later commanded divisions, corps, armies, squadrons, or fleets in active campaign, we would have a very clear conception of the Roman Senate in its best days, from the expulsion of the Roman kings to the establishment of the empire under Augustus. In ability, experience, mature judgment, and variety of talent, no other legislative body has ever rivalled the Roman Senate. Truly it was, as Polybius called it, an assembly of kings.

Politically, Rome's international policy was defensive. Her military policy in war was offensive. Rome did not bring on war for the purpose of making conquests. The best general proof of this is that she almost always began a war with a series of defeats; but she was invariably successful in war and never made peace after a defeat. The real explanation of her wars seems to be that she gained the contempt of her fellow nations by her extremely pacific attitude in time of peace. They regarded her as Germany regarded the United States prior to her entry into the World War and for many months thereafter; and they received the same unpleasant surprise as Germany received in the summer and autumn of 1918.

One of the basic principles of Rome's foreign policy was a deliberate repudiation of conquest as an end in itself, as something which serves only to entrap the victim in foolish, ill-judged, and chimerical enterprises. Conquest came to the Romans as an incident of war and was accepted most grudgingly. If Rome had shown the eagerness to annex every acre of land that she could have annexed, she would have been so tied down with imperial responsibilities that she would probably have succumbed to one of the primary powers.

The expansion of the Roman state was very slow. It began to the southward by alliances which Rome formed with other lowland cities to resist the attacks of the mountain tribes occupying central Italy from the latitude of Rome almost to the heel of Italy. Rome formed a confederation with these cities, with herself as the leader and coercing member. The attacks of the mountaineers, or Samnites, successively drove nearly all the cities into an alliance with Rome. The relations of Rome to the other members of the confederation bear a marked resemblance to the relations of Prussia to the smaller German states after the formation of the North German Confederation in 1866-67. When a city-state had once been driven by hard necessity to join the Confederation, it could never get out,

as Rome's treaties were made for all time; and, when Rome's foreign wars began in the year 280 B. C., the greater part of Italy south of Rome was within this unbreakable Confederation. It should be noted that Rome did not tax her allies, in the period under consideration; and she made no effort to administer their territories. The faithfulness of Rome's allies came as a complete surprise to Hannibal and Pyrrhus when they attacked Rome in Italy.

Rome's first contest with overseas enemies took place on Italian soil. Pyrrhus, King of Epirus, the ally of the Greek city of Tarentum in south Italy, landed 25,000 men and 20 elephants at Tarentum in the spring of 280, B. C.

The next year Rome made a treaty with Carthage in which each state pledged itself not to make a separate treaty with Pyrrhus; but the two nations did not fight as allies. The Carthaginians were content for Pyrrhus to ravage southern Italy, so long as he did not become too strong; and the Romans were not averse to seeing Pyrrhus depart for Sicily, which he did in 278. After three years of war with the Carthaginians in Sicily, Pyrrhus returned to Italy, was beaten by the Romans in a great battle, and finally returned home in 274. The Romans continued the war against his allies and soon established their authority over southern Italy.

From the beginning to the end of her history, Roman policy was largely dominated by fear of the attack of northern barbarians. For more than two centuries she maintained a row of buffer states whose southern borders were only two or three days' march from the city, as a protection against the barbarians; but when, in 285, the Gauls crossed the Apennines and one of the buffer states chose war against the Romans rather than war against the Gauls, Rome saw the futility of attempting to protect herself by weak buffer states; and she pushed her military frontier north to the Arno on the west coast and the Aesis on the east coast, where it lay in 264, when the First Punic War broke out. The Romans were now masters of Italy from the Arno to the Sicilian straits. It had taken two and a half centuries to bring about this result.

Rome's wars with Carthage furnish analogies and comparisons which throw much light upon the military and naval relations of the great powers today. When the first Punic War broke out in 264 B. C., Rome was a continental, land power, without naval forces, but possessed of an army practically invincible on land. She had recently defeated and driven from Italian soil the best Greek troops led by a general brought up in the school of Alexander the Great.

Carthage was a sea empire holding possession of Corsica, Sardinia, western Sicily, the Balearic Isles, and a vast ill-defined region in north Africa. Her land forces were inferior in number and qual-

ity to Rome's levies and she could not hope to defeat the Roman troops on Italian soil, nor Greek troops in any of the succession states of the empire of Alexander the Great; but she was mistress of the western Mediterranean. So long as she held command of the sea she could continue to build up a sea empire by conquering secondary states, and she could limit the overseas conquests of the primary states, particularly Rome.

The first Punic War lasted twenty-three years, gave control of Sicily to Rome, and disclosed the secret of world empire to the Romans. It taught them how, by a combination of superior land power and superior sea power, they could impose their will upon other nations.

The war was carried on chiefly in and about Sicily. The Romans soon felt the need of a fleet and proceeded to build one with Roman thoroughness. In a great sea fight off Mylae in the fourth year of the war, 260 B. C., they sank or captured the Carthaginian fleet. In 257 the two consuls, Regulus and Volso sailed for Africa with 40,000 men in a fleet of 330 ships manned by 100,000 sailors. Enroute they met and defeated a Carthaginian fleet of 350 vessels off Ecnomos, manned by an equal or greater complement, in the greatest naval battle of history, if the number of combatants engaged be taken as the standard of comparison.

The Roman army landed in Africa, overran the country, and captured and sent 20,000 slaves to Rome. The Carthaginians sued for peace. Regulus offered terms which showed that he comprehended the consequences which follow when a country with an invincible army gains command of the sea. He proposed that Carthage should become a dependent ally of Rome and should keep only such vessels as were required by Rome in her wars. In its confidence, the Roman Senate recalled its forces, except 15,500 infantry and cavalry, which were left in Africa under Regulus. The Carthaginians gathered together their forces, defeated Regulus and captured all his troops, except 2000 men, who took refuge on the bay of Clupea. When the news reached Rome, a fleet of 350 vessels was sent to Africa. It defeated a Carthaginian fleet and sank or captured 114 vessels. But it brought no reinforcement; for it came only for the purpose of withdrawing the garrison of Clupea. On the return voyage, three-fourths of the fleet was lost in a storm. Both sides reinforced their armies in Sicily and the miserable indecisive war was renewed in that island. The withdrawal from Clupea entailed the continuance of the war for fourteen years, and if rightly understood, the terrible war with Hannibal. When Scipio landed in Africa fifty-two years later he occupied the ground which the consuls should have occupied for the summer campaign of 256.



Ill-luck pursued the Romans at sea. Within a period of six years they lost four fleets, three of them by storms, three of them with armies on board. After the destruction of the last Roman fleet in 249, both sides relaxed their efforts at sea. The cause of Carthage was sustained by the personal capacity of Hamilcar Barca, her commander in Sicily. Finally, in the 23d year of the war, a band of patriotic Roman citizens built a fleet of 200 vessels by subscription and manned it with 60,000 sailors.

This fleet gained an overwhelming victory over the Carthaginian fleet off the island of Aegusa on March 10, 241; the Carthaginians crucified their admiral and authorized Hamilcar to make peace with the Romans. By the terms of the treaty, the Carthaginians ceded the western part of Sicily and the Lipari Islands to Rome and agreed to pay an indemnity of 3200 talents (\$4,000,000) to Rome, one-third at once and the rest in ten annual installments.

The most important result of this war was the discovery made by the Romans that they were invincible upon the sea as well as upon the land. Henceforth no nation was safe from their attack; and the possibility of maintaining a *modus vivendi* among a number of independent states was at an end. If Carthage, the weaker power on land, had retained command of the sea, she would not only have been able to defend her own territory, but she could have assisted the other primary powers against Rome; and Macedonia, Greece, Egypt, and the kingdoms of Asia would most probably have retained their independence.

The situation invites comparison with conditions which have prevailed in Europe since the time when England realized that she could not compete on land in the continent of Europe with the formidable land powers of the continent. When England, at the close of the middle ages, was compelled by military weakness to renounce her ambition to establish her ascendancy upon the continent of Europe similar to that which had formerly belonged to Rome (she set herself the task, consciously or unconsciously, of preventing any other nation from dominating Europe. She has done this by her ability to control the sea and has thwarted the designs of every would-be conqueror of Christendom—Philip II, Louis XIV, Napoleon, and William II.

There seems to have been nothing in the treaty of 241 which restricted the right of Carthage to build a navy; but henceforth she renounced her ambition to control the sea; and Rome became to the contemporary world what Spain under Philip II, France under Louis XIV and Napoleon, and Germany under William II, would have been to the modern world, if they had beaten the English at sea.

Within a period of sixty years after the battle of Aegusa, Rome had reduced every primary state to the position of a secondary state; but to the credit of her statesmen, it must be said she attacked none of them. Her political policy was pacific and unaggressive; but her military policy in war was the unlimited offensive, when once she was aroused by a few preliminary disasters with which she began most of her wars.

In the interval between the First and Second Punic Wars, the Gauls twice attacked Rome. In the second foray, in 225 B. C., a large force of Gauls reached Clusium, three days' march from Rome. The Romans were thoroughly aroused: they drove back the invaders; and then addressed themselves to the conquest of north Italy. In 222 the Romans had carried their military frontier to the Alps. They were building roads and settling the conquered territory, when, in 218, they were interrupted by the arrival of Hannibal in Italy.

Everybody is familiar with the story of the Carthaginian conquest of Spain by Hamilcar Barca, and by Hasdrubal, and Hannibal, the son-in-law and son of Hamilcar, for the purpose of establishing a base on the continent of Europe for a war against Rome. Rome was aware of the hostile intentions of the Carthaginians. She became alarmed, and, in 226, she secured a treaty with Hasdrubal whereby the Carthaginians agreed not to cross the Ebro in arms. As a further measure of security she entered into a defensive alliance with Saguntum, a Greek city, one hundred miles south of the Ebro.

When at length Hannibal attacked Saguntum, Rome failed in her duty to support Saguntum; she contented herself with protests; and, after a siege of eight months Hannibal took the city. Then and not until then, the Romans sent an ultimatum to Carthage and, upon its rejection, declared war. Hannibal had hoped to draw forth a declaration of war from Rome; and, Bismark-like, he succeeded. The design to invade Italy by way of the Alps was a profound secret of the Barca family; and the march of Hannibal through Gaul which was not discovered until he was crossing the Rhone, came as a complete surprise to the Romans. Hannibal purposed to destroy Roman sea power by victories on Italian soil.

Rome planned to send, in the summer of 218, an army of 24,000 men under the consul Publius Scipio to Spain, a somewhat larger army under the consul Sempronius to Africa, and a third army under a praetor to the valley of the Po. Scipio, on his way to Spain, put in at the mouth of the Rhine and heard of Hannibal's crossing the river. His cavalry had a skirmish with Hannibal's cavalry, but when he marched up the river, he found that Hannibal had departed for the Alps. Scipio sent his army to Spain under his brother Cneas and returned to Italy to reorganize the forces to

meet Hannibal when he should emerge from the Alps. The army of Sempronius was recalled and sent north against Hannibal.

Hannibal arrived on the Po with an army of 26,000 men and 37 elephants; but he was soon joined by the Gauls who, from first to last, furnished him 60,000 infantry and 4000 cavalry. Late in the year he defeated the Romans on the Trebia, inflicting upon them a loss of 20,000 men. In the spring of the next year, he started on a leisurely march for south Italy. He entrapped a Roman army at Lake Trasimene, killing 40,000 men; spent a month on the shores of the Adriatic, reorganizing his army after the Roman model and rearming his African Infantry from the spoils of the battlefield; and then he continued his march unmolested. The next year (216 B. C.) he gained the most complete and striking victory of recorded history at Cannae, where 70,000 out of 76,000 Romans lay upon the field. Eighty-one Roman senators fell at Cannae.

One-seventh of the Italians of fighting age had fallen. Two young military tribunes, Appius Claudius and Publius Scipio, the future conqueror of Hannibal and son of the pro-consul commanding in Spain, rallied the fugitives from the field of Cannae; the consul Varro joined them; and thus two legions were gradually collected, and a third was sent down from the fleet at Ostia. For some time these were the only troops that could be opposed to Hannibal, who was expected daily before the gates of Rome. But he did not come, because his invasion of Italy was merely a hugh raid of cavalry, infantry, Balearic slingers, elephants, and pack-trains, without artillery or siege material, bearing little resemblance to the systematic invasions of Alexander, who could besiege cities as well as win pitched battles. Hannibal depended for success upon open field fighting and the treachery of Rome's allies. The Roman armies were safe within their fortified camps and the cities within their walls. Information came later in the year that the Gauls had destroyed a Roman army on the march by felling trees upon it. But the gloom of this year was relieved somewhat by good news from Spain. The Scipio brothers, Publius and Cneus, had totally defeated Hasdrubal Barca (the brother of Hannibal) on the Ebro, which would prevent him from marching through Gaul to the aid of Hannibal in Italy.

Shortly after Cannae, Hieronymus, king of Syracuse, joined the Carthaginians and ordered his fleet to aid the Carthaginians; and Philip V of Macedonia, made a treaty with Carthage whereby he agreed to land an army in Italy. Thus within three years after Hannibal had crossed the Alps, Rome found herself at war with enemies in the following geographical areas, which for all practical purpose were so many separate, independent nations: Africa, Spain,

Sicily, Macedonia, with the Gauls on the Po, and with Hannibal in south Italy. Here was a real world alliance against a continental power, whose territory was limited within very definite bounds in central Italy. It is instructive to compare this alliance against Rome with somewhat similar alliances against Spain, France, and Germany in modern times. Politically, Rome held the position of Spain under Philip II, France under Louis XIV and Napoleon, and Germany under William II, in that she was the mighty land power against which the weaker nations united; but strategically and tactically, she occupied the position of the allies in modern wars as she held command of the sea. As she did hold command of the sea, no Macedonian and few Carthaginian soldiers were landed in Italy; and she was at liberty to make war, or refrain from making it, in the countries outside of Italy, as suited her purpose. She triumphed over her numerous enemies because she was able to divide them and attack them one by one. In modern times, the allies have had command of the sea and they have triumphed because they could combine their efforts against the common foe and isolate him from the resources of the neutral world.

The Romans had a most effective and complete command of the sea in this war. Whilst they were able to transport armies freely by sea, both Hannibal and his brother, Hasdrubal, led their armies to Italy by the long and perilous land route over the Alps; but there were instances of the evasion of the Roman fleet, of which Hannibal's return to Carthage by sea is the most striking example.

The Romans made a most excellent use of their command of the sea. They sent an army to Sicily, besieged and took Syracuse, the most magnificent of Greek cities, and finally expelled the Carthaginians from the island in 210; they sent a division to Macedonia, raised a coalition of Greek states against Philip and harrassed him until he was glad to make peace in 205; they maintained an army in Spain and, after many defeats and victories, they expelled the Carthaginians from Spain; and finally, they invaded Africa, forced the recall of Hannibal, and compelled Carthage to make peace.

Hannibal's troubles began after Cannae. He suddenly found that he had a frontier to defend and allies that demanded his protection. His territory embraced south Italy as far north as Voltunus and Mens Garganus. He found himself on the defensive. Roman armies were penetrating his territories and relieving fortresses. Whenever a Roman army became too venturesome he destroyed it; but in 210 Marcellus fought a drawn battle with him and in 209 gained a victory, but in this same year, 209, Hannibal destroyed a consular army and killed the consul.

After the defeat and destruction, in 207, of the army of Hasdrubal, who had passed around the northern extremity of the Pyrenees and crossed the Alps, Hannibal retired into the land of the Bruttians, whose ports would enable him to withdraw to Carthage.

The final battle, fought on the plain of Zama, near Carthage, in 202 B. C., was so complete that Rome could dictate such terms as she pleased to Carthage. Carthage was required to cede to Rome her possessions in Spain and the Mediterranean; to deliver up her elephants and all but ten of her warships; to restore the throne of Numidia to Massinissa, whom Rome proposed to support as a rival African power against Carthage; to pay an annual tribute of 200 talents (\$240,000) for fifty years; to wage no war against Rome or her allies, nor beyond the limits of Africa at all, nor in Africa beyond her own territory, without the permission of Rome; and, perhaps, to furnish auxiliary ships to the Roman fleet. It will be observed that Rome limited the fleet of Carthage to a definite number of ships; but she made no attempt to prescribe the strength of the Carthaginian land forces. She merely prescribed what Carthage would be permitted to do with her army. She did annex Spain, in order to prevent it from becoming a base of operations for a new war in Italy, but she took not a foot of African territory. Spain became a costly, rebellious province which required the presence of a regular garrison of 40,000 men. It did not become self-supporting until the age of Augustus, nearly 200 years later.

One effect of the practical military education of every Roman statesman was that the question of annexing territory dependent almost wholly upon whether or not the new territories possessed good natural frontiers. The Romans at the time of the Punic wars and for many years thereafter religiously avoided transmarine possessions upon the mainland of the great continent which could possibly bring them into direct contact with a primary power or with untamed savage tribes. Such possessions would compel them to maintain large forces constantly under arms; and the cost of the garrisons would be greater than any possible economic advantages that might be derived from them. Islands stood upon a different footing. The command of the sea in all ages has enabled its possessors to hold islands with such troops as are required by the needs of domestic tranquility in the islands; and command of the sea was a cardinal principle with the Romans after their first war with Carthage. Hence we see that while Rome never hesitated to annex an island, she withdrew time after time from territories on the mainland which her armies had overrun and conquered in her wars.

Two years after her victory at Zama, Rome joined a coalition of powers formed to resist King Philip V of Macedonia, who had

begun a career of conquest. Rome sent two legions to Greece under her proconsul, Titus Quinctius Flamininus. In 197 her forces gained an easy and decisive victory over the Macedonian phalanx, to the infinite surprise of the Greeks. In the peace which she dictated to Macedonia, she left Macedonia proper, practically undiminished, but she required Philip to give up his possessions in Greece, Thrace, the Aegean, and Asia, to conclude foreign alliances only with the consent of Rome, to make no war against civilized states outside of Macedonia nor against Rome's allies at all, to reduce her army to 5000 men, to keep no elephants and not to exceed five war vessels, to give up all surplus war vessels to the Romans, to enter into a defensive alliance with Rome and to furnish contingents when required, and to pay a contribution of 1000 talents (\$1,200,000).

To dispel all doubt as to the good intentions of the Romans, a herald at the Isthmian games of 196 proclaimed that:

The Roman senate and Titus Quinctius, proconsul and imperator, having conquered King Philip and Macedonia in war, declare the following peoples free, without garrison or tribute, in full enjoyment of the laws of their own countries: namely, Corinthians," etc., (nine states named).

Flamininus spent two years in Greece in reconciling the jarring states and adjusting their differences. Whilst negotiations were taking place, Sparta ran amuck, and the Romans smashed her army. Rome imposed terms on Sparta similar to those imposed on Macedonia, except that the number of Spartan war vessels was limited to two, and there was no limitation upon the strength of the Spartan army.

In the spring of 194 the Romans evacuated Greece. In accordance with a plan which she had followed in Africa, Rome took no transmarine possessions for herself but gave all territorial gains to her allies.

Scarcely had the Romans evacuated Greece, when Antiochus, King of Syria, who had crossed into Europe in 196, overran the country. He had been completely deceived by the disinterested action of the Romans in Greece. He believed that Rome had been cajoled into the Macedonian War by Rhodes and Pergamus, and that if he could retain the good will of these two states he could tear up the treaty of 196 and overrun the Greek East, just as the Germans of today believe that they could overrun Europe without exciting our interest, provided that they refrain from the use of the submarine. The presence of Hannibal at the headquarters of Antiochus was peculiarly significant to the Romans. Rome did not desire oversea possessions; but she was ready to strike down any state

that might possibly renew in Italy the horrors of the Hannibalic war. She had slept while the Barcas were preparing their base in Spain; but she was now on the alert. In 192, Rome landed troops in Greece. In 190, Publius Scipio drove Antiochus into Asia, followed him, defeated him with enormous slaughter at the cost of 324 Roman soldiers, and imposed the typical Roman peace treaty upon him.

Within a period of twelve years, Rome had imposed peace upon Carthage, Macedonia, Sparta, and Syria. The most striking feature of these treaties is the fact that she forced naval disarmament upon each defeated nation. Carthage was allowed to keep ten war vessels, Macedonia five, Sparta two, and Syria ten. Disarmament on land was a more difficult matter, because each defeated state had its own problem of domestic peace, which required the services of an army, and three of the four states were in immediate contact with barbarians. Rome desired these border states to act as buffer states between herself and the barbarians. Moreover, naval disarmament was more easily superintended than disarmament on land. Macedonia alone was limited in the size of her army; but this provision was a dead letter from the day the treaty was signed. When the son of Philip renewed the war he brought a veteran army of 40,000 men into the field.

Rome evacuated Asia in 188 and the second evacuation of Greece soon followed. Rome took no territory, except two small islands which she retained as naval bases in the east.

In 172, the third Macedonia war came on. The Romans met disaster after disaster during three years. In the fourth year, they sent out as commander the consul Lucius Aemilius Paullus, an old and experienced soldier. The old general made his coming forever memorable by turning the enemy's flank and forcing him to give battle at Pydna, where in less than an hour the legions overcame the phalanx, June 22, 168, a date which is accurately fixed by an eclipse of the moon.

Polybius dates from the Battle of Pydna the full establishment of the universal empire of Rome. It is true that Roman sovereignty and government extended only over Italy, Spain, and a number of islands in the Mediterranean; but she had destroyed every primary power in the civilized world, and henceforth, for seven centuries only shifting nomads and the intractable Parthians successfully disputed the decrees of Rome and there was only one free will between the Euphrates and the Atlantic. Rome was the one great primary power in the world, surrounded on every side by barbarians and secondary powers.

After the fall of Macedonia, Rome did not hasten to absorb the secondary states which lay within her grasp. Paullus organized Macedonia into four autonomous republics having unicameral representative governments. Macedonia did not become a Roman province at this time; but Rome disarmed the Macedonians and took over the defense of the northern frontier against the barbarians. About twenty years later, at the end of the fourth Macedonian war, Rome formally annexed Macedonia. About the same time, the Romans who had again occupied Greece during the Macedonian troubles, carried out their third evacuation of the country. More than a century was to elapse before Greece became a Roman province. Athens was never placed under the fasces of the Roman governor, and she never paid tribute to Rome.

The impetus for the annexation of the secondary nations came not from the Roman Senate, but from a series of popular leaders and revolutionists. That series includes the names of Tiberius and Caius Gracchus, Marius, and Julius Caesar.

Tiberius Gracchus, the leader of the People, first advocated a policy of annexation, such as Japan and most of the European governments have pursued in modern times and such as we ourselves pursued prior to the Civil War. Gracchus, in the year 133, urged that with plenty of freemen to fill their armies, the Romans would soon become the masters of the rest of the habitable world. He effected small conquests in Gaul and eagerly accepted the Kingdom of Pergamus in Asia, which the last king had bequeathed to the Romans in his will.

Civil strife and foreign annexations marked the period from the time of Tiberius Gracchus until the Roman dominions were united under the personal rule of Octavius Caesar, better known by his title of Augustus.

The Roman province of Africa was taken over at the end of the Third Punic War, 146, B. C.; Achaia, the same year; Pompey annexed Syria and other possessions in Asia in 61; Caesar annexed the greater part of Gaul in 56; Augustus annexed Pannonia in 35 B. C., and Germania, Moesia, and Egypt in 30 B. C., and Rhaetia and Noricum, 15 B. C.

Sea battles played a small part in the wars of this period. Rome had long since destroyed every navy in the world. The Mediterranean had become a Roman lake, which was effectually controlled by her naval forces.

When Rome ceased to fear any primary power, she allowed her navy to fall into decay; and the command of the sea passed into the hands of pirates. The evil became so bad that Pompey in 65 B. C., was given command over the Mediterranean and over the coast



for fifty miles inland, with authority to raise 120,000 infantry, 7000 cavalry, and 500 ships of war. Pompey accomplished his task within three months.

Pompey was the uncrowned emperor of Rome from 70 to his defeat by Caesar at Pharsalia in 48. Caesar ruled for four years. After the defeat of Pompey at Pharsalia, the sons of Pompey took to sea. They commanded an effective naval force and caused no end of trouble to triumvirs, Octavius Caesar, Mark Antony, and Lepidus, who divided the Roman world amongst themselves in 43. Octavius despoiled Lepidus of his share of the empire and overthrew the last of Pompey's sons in 36; and the Roman world was divided between Octavius and Antony, somewhat on the lines of the later division between the eastern and western empires.

There were now two rival military and naval powers. The defeat of Antony in the naval battle of Actium on the coast of Epirus, August 1, 31 B. C., ended the rivalry and established Octavius as the ruling personality in the Roman state. When Augustus became undisputed master of the Roman world, he set himself the task of establishing order, efficiency, and economy in the government, and security of life and property within the empire. He crushed all opposition in the Roman state. He sold whole tribes into slavery and forced others to migrate. He waged war on the mountaineers in the Alps and in Spain, built roads and harbors, and made settled life possible for the first time over a large part of south Europe, western Asia, and northern Africa. The great endeavor of his reign, which lasted 43 years, was to reach secure frontiers on every side; and he bequeathed as a valuable legacy to his successors the advice to confine the empire within those limits which nature seemed to have set as its permanent bulwarks, namely the Atlantic, the Rhine and Danube, the Euphrates and the sandy deserts of Arabia and Africa.

The Romans conquered and expanded as a republic. The emperors were content, with few exceptions, with the boundaries which had been acquired by the republic.

The military peace establishment of the successors of Augustus consisted of approximately thirty legions, each of which, with its attendant auxiliaries amounted to about 12,500 men, or a total of 375,000 men. The emperors maintained two main fleets, one at Ravenna on the Adriatic and the other at Misenum in the Bay of Naples. They had smaller fleets at Frejus on the coast of Provence, on the Euxine or Black Sea, on the Channel, and on the Rhine and Danube. The task of these forces was to protect the frontiers against the raids of barbarians and to maintain the domestic peace of the empire, whose greatest length from east to west was 3000 miles and whose greatest breadth was about 2000 miles. The area

of the empire was about 1,600,000 square miles and the population about 120,000,000.

I wish to draw attention to a marked distinction between the policy of Rome in the days when she was struggling with the primary powers in the Mediterranean world and that of the ambitious states of the modern times. Rome overthrew the primary powers without any desire to annex their territories. Not until the age of Pompey, Crassus, and Caesar, a century after she had overthrown her last great rival at Pydna, did Rome deliberately send forth expeditions to gather the spoils of the secondary states which she had left untouched upon her frontiers. Unhappily for the truth of history, men have agreed in ascribing the political policy of this later period of Roman history to the earlier era. In the earlier period, Rome was attacked by powerful neighbors. That she should have overcome them and trod on their necks and ruined their works and that she should have disdained to appropriate their spoils, strikes one as unnatural and reads like a fable; but she owed her ultimate success in the world to her wise policy of caution. There can be no doubt that Rome's ultimate decadence and downfall were due in a large measure to over-expansion; but this over-expansion was not carried out by the able men who made it possible. Philip II, Louis XIV, Napoleon, and William II learned their policy from Pompey, Crassus, and Caesar, rather than from the Roman consuls who destroyed the primary powers of the ancient world.

I need hardly point out how closely our policy resembles the early Roman policy. We have accepted islands in the Atlantic and in the Pacific; we have taken over Alaska and Panama, which are insular in character; and we have refused continental possessions, which would bring us into contact with strong military powers.

Our two withdrawals from Cuba, our return of the Chinese indemnity, our restrained attitude towards Mexico and certain other Latin-American states, and our complete withdrawal from Europe, are not pure altruism, however much the persons who were immediately responsible for our course may have thought that they were acting from motives of pure altruism. These acts were part and parcel of the highest wisdom. We often reproach ourselves with having no policy. It seems to me that we have a very wise policy, though we may not know it. Our policy is wiser than our views of it.

Rome conquered the ancient civilized world because she combined superior land power and superior sea power. This is the great strategical lesson of her history. The great coalition wars of modern times, in one of which we bore an important part, have all been directed against nations that have tried to combine superior land power and superior sea power.

# The Battles of Ludendorff On the Russian Front\*

By GENERAL HUBERT CAMON, *French Army*

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EDITOR'S NOTE: General Camon served for many years as Instructor and Director at the Artillery and Engineer School of Application at Fontainebleau, and as Assistant Commandant at the Ecole Polytechnique. In 1913 he was promoted to Brigadier General and made Chief of Artillery of the 14th Army Corps at Grenoble, in which capacity he served during the early part of the World War. Thereafter he served as Inspector General of Artillery Munitions Factories. His writings include "A Summary of the Campaigns of Napoleon," "Napoleon's Theory of War," "Battles," and "The Breakdown of the German Plan in September, 1914." General Camon is recognized as an authoritative military writer.

THE strategy of Ludendorff shows a remarkable similarity to that of Napoleon, whose successes were largely due to his maneuvers against the rear of the enemy's army. But does he show the same preference for the Napoleonic scheme of battle? Let us find the answer to this question by analyzing his three great battles at the Eastern Front in 1914-1915, namely, the Battle of Tannenberg, Masurian lakes or Insterburg, and Augustowo.

The confused engagements, uncorrectly called the battles of Lods (19-21 November, 1914) and Vilna (September, 1915), which resulted from the maneuvers of the German and Russian armies, can hardly be called battles. We will discuss them briefly however to show the logical sequence of events caused by these operations.

It seems necessary also that we form a basis of analysis of Ludendorff's battles by bringing back to our minds in a few words the schemes of battle of those great warriors of the past, who served as an inspiration to Ludendorff as well as to Moltke and Schlieffen.

*Victory is the problem of battles, whether it be attained with an army numerically superior or inferior to that of the enemy.*

Let us see, then, how this has been accomplished throughout the centuries.

THE SYSTEM OF HANNIBAL AT CANNÆ (216 B. C.).—After having annihilated two Roman armies in Trebia (Dec., 218 B. C.) and at Trasimene in the spring of 217 B. C., Hannibal led his army southward into Apulia along the Adriatic coast to get supplies for his troops. Then he continued on to Samnium, followed by the dictator Fabius who was in command of the hurriedly mobilized Roman and Allied troops.

\* In three parts. The two succeeding parts will appear in the September and October issues of the JOURNAL.

After having returned to Apulia, Hannibal captured the small village of Cannae, where the Romans had a large depot of food supplies. Pabius followed him, harrassing the Carthaginian army, but avoiding a battle. When the Roman command was turned over to the two consuls, Paul-Emile and Varron, the Roman army comprised 63,000 infantry and 6000 cavalry. The Carthaginian army only consisted of 40,000 men, which included 10,000 seasoned Libyan troops and 10,000 veterans of the wonderful cavalry from the Numidian desert of North Africa.

As soon as he assumed command, Varron, firmly believing that success was a certainty, decided to engage in battle in order to prevent his colleague from partaking of a glorious victory. He massed his troops on a narrow front, so as to deliver a smashing blow. His

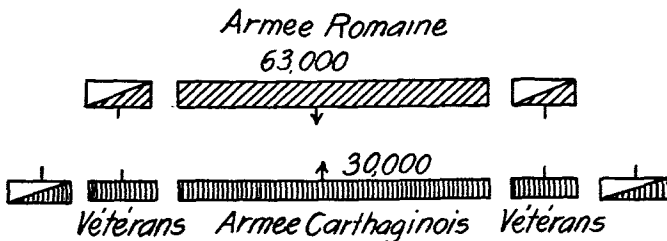


FIG. 1

DEPLOYMENT OF FORCES—BATTLE OF CANNÆ

cavalry was covering the two flanks, but his 63,000 infantry occupied a front of but 1800 meters wide.

Hannibal with his 30,000 infantry, occupied a front equal in width to that of the Romans, but was deployed in about one-half the depth. His center was formed by Iberian and Celtic troops, with the veteran Libyan soldiers on the flanks, which extended beyond the Roman line. His cavalry completed the encirclement.

The Romans dashed to the attack and broke through Hannibal's center, but while the legionnaires were advancing in disorder, the African veterans fell upon the flanks of the Roman mass. The Numidian cavalry defeated the Roman horseman who opposed them, then swung around and fell upon the Roman lines from the rear. Thus the Roman Army was hemmed in. As the circle kept narrowing, those towards the center were not free to move and could not use their weapons. Retreat was impossible. The Romans left 50,000 dead and wounded upon the field, and the rest were taken prisoners.

The system of Hannibal requires forces nearly equal to that of the adversary, but if that is not possible, should plans for a victory

be given up on that account? Not by any means, because a quick blow at one point of the hostile front may produce a total disorganization, which will spread throughout the enemy forces. This system was employed by Epaminondas at Leuctra and later, when adapted to the armies of the 17th century by Folard and Marshal de Puy-seguir, it served as an inspiration to Frederick II at Leuthen. It was to be finally modified by Napoleon.

LEUCTRA.—On July 8, 371 B. C., a Spartan army, composed of 10,000 infantry and 1000 cavalry commanded by King Cleombrotus, deployed in front of the Theban army commanded by Epaminondas, which was camping near Leuctra. The latter only comprised 6000 men lightly armed and 500 cavalry.

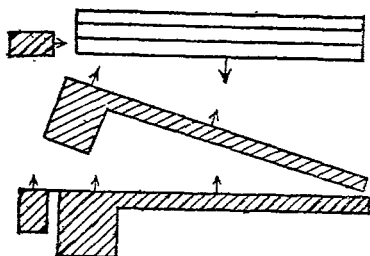


FIG. 2

FORMATION AT THE BATTLE OF LEUCTRA

Cleombrotus placed his cavalry in the first line and his infantry in the second, his line of battle having a mean depth of 12 men.

If Epaminondas had deployed his army using the same depth as the Spartan army, the latter could have easily extended its flanks and swallowed the small Theban army. However, the Theban general abstained from doing so. "He carried out," says Folard, "the stroke of a skillful and accomplished captain." His plan consisted in crushing the enemy's right by superior forces, massing against this flank 3000 infantry and his famous "battalion of the 300," that is to say, one-half of his forces, and leaving the rest of the army to prevent the enemy from sending reinforcements to the threatened flank. His front was equal to that of his enemy in width, but not in depth.

The Theban front which originally extended parallel to the Spartan front, was suddenly pivoted to the right, in order to assail the enemy's right with a solid mass. The Theban cavalry overthrew the Lacedaemonian cavalry, which was poorly organized, and the "battalion of the 300," fell upon the enemy's right. This flank, crushed by superior forces, was soon completely routed, and this de-

feat soon extended along the entire Spartan front. Clembrotus and 1000 other Spartans, comprising the flower of his army, were killed.

The system of Epaminondas is based upon a surprise attack against the enemy flank by superior forces, and upon the impossibility of its timely prevention, due to the rigidity of the formation.

The strategy used at Leuctra, was the inspiration of the one put into effect at Leuthen 2000 years later.

**BATTLE OF LEUTHEN, 1757.**—Up to the epoch of Frederick II, the armies were handled in such a manner, that once deployed, it became impossible to modify the maneuvers in order to meet an unex-

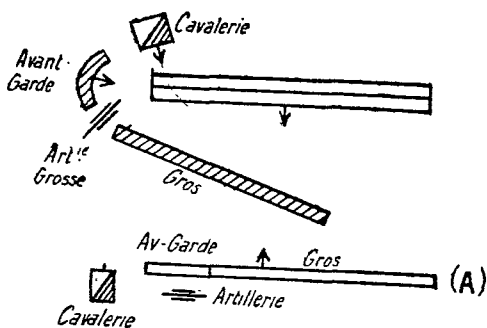


FIG. 3

FORMATION AT THE BATTLE OF LEUTHEN, DEC. 5, 1757

pected attack. Marshal de Puyseguir, desiring to see the system at Leuctra realized, conceived in his "Art de la Guerre," a tactical movement which would make it possible to concentrate sufficient forces against one of the enemy's flanks and thereby crush this flank before the adversary could bring enough troops to prevent it.

This is the plan. Deploy the army in battle parallel to the enemy front as if it contemplated an attack on the entire front, then form in column by the flank. After having done this, direct the head of the column against the enemy flank which is to be attacked and enveloped. This attacking mass is composed of cavalry, advance guard and artillery, and is supplied by the rest of the army, which in its oblique march will keep itself out of range of the enemy's guns.

Frederick arranged his army in many of his battles according to the strategical maneuvers conceived by Marshal de Puyseguir. Its triumph was the victory of Leuthen.

Napoleon, in his analysis of the battles of the Prussian monarch, states that Frederick's victories were due more to his ability to con-

ceal the approach of his attacking mass and thereby surprising the enemy, rather than to his strategical maneuvers.

Such a system assumes that the adversary should remain in a fixed position. When Soubise, at the battle of Rosebach, tried to use the same against the Prussian Army, Frederick threw himself on the former's flank, inflicting a decisive defeat.

Forty years later, during the days of the French Revolution, the armies had attained enough mobility to arrive at the desired place on time, unless they were detained for a combat along the front. Napoleon completely modified the scheme of Leuthen years later.

**NAPOLEONIC BATTLE.**—Napoleon's system of battle is also based upon a *main attack*. In 1794, he wrote "In all systems of

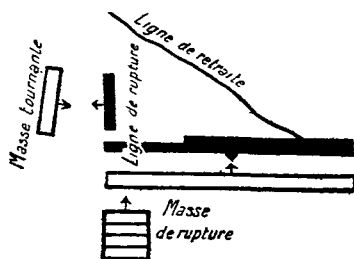


FIG. 4

THE NAPOLEONIC SCHEME OF BATTLE

warfare and sieges of fortresses as well, all forces must be concentrated at the same point. After the front is broken, the equilibrium is lost, and everything else becomes useless. It is essential not to disseminate the attacks, but to concentrate them.”\*

He applied this principle in his battle. Like Epaminondas and Frederick, he delivered his main blow against one of the flanks, but instead of selecting the flank which the attacking mass could more easily approach under cover, he selected the one behind which was the enemy's line of retreat. We shall presently see his reasons.

This main thrust was made after having immobilized the enemy by an attack in which the adversary was compelled to use his reserves. The French troops perfectly understood how to carry out such attack with a minimum of losses.

Furthermore, to shake the selected enemy flank, Napoleon first would throw it in disorder, materially and morally, by threatening its line of retreat with a turning attack that would take the adversary by surprise. As a result, the enemy having used its reserves in the frontal attack, was now compelled to take troops from the threat-

\* From the report of General Bonaparte, army artillery commander, to young Robespierre, representative of the people, with this army.

ened flank, in order to face this turning attack, thus disorganizing the very flank which the attacking mass was about to assail.

It would be, indeed, an error to see in the combination of the outflanking and turning attacks merely a scheme to concentrate the forces, for the turning attack causes a demoralizing effect, producing a critical moment in the enemy's ranks, of which the mass which is to strike the main blow takes advantage. Marshal Saxe has said that men lose their heads when something unexpected happens, and this rule has, in general, held true in all battles.

The cavalry precedes the turning attack, forming a screen, which serves to conceal the approach of the assailing mass. The enemy is thus taken by surprise, is demoralized, and at the same time cannot bring in means with which to oppose the attack. When the assault mass is unmasked, the cavalry prepares to attack the enemy's line of retreat.

The turning mass must effectively prevent the adversary's retreat, if decisive results are to be attained. Napoleon, by his maneuvers, had already cut off the enemy's line of retreat, and inverted the battle fronts. By this time, victory was almost complete and the French army usually finished the enemy in the pursuit.

**THE BATTLE OF MOLTKE.**—In 1866, when Bismarck and Moltke thought that the moment had arrived for the formation of a united Germany, at the expense of Austria, the rifle and cannon had made such improvements in range, effectiveness and rate of fire, that the German General Staff believed that it was no longer possible to make a decisive attack based on the Napoleonic scheme, the moral forces of which it could not understand.

"Napoleon," wrote Schlieffen, years afterwards, "selected his point of attack and there concentrated all his available forces, trusting his success to a heroic, superhuman assault, which would open a gap and overthrow the entire enemy line."

Moltke did not believe in the possibilities of this assault. His conception was to crush the enemy by an *envelopment* with superior forces.

In 1866 and in 1870, Moltke divided his forces into three armies, influenced by the arrangement of the Prussian and Allied territories, in order to facilitate the concentration and assure the initial security of these territories. His sole strategy was the converging of the three armies on the presumed enemy concentration point.

This was a contradiction of Clausewitz' theory of "bloc," but the latter also said: "There may be situations, in which the initial division of forces and their converging march may be justified. This procedure gives, besides, real advantage, because by the converging



actions, the enemy is not only beaten, but more or less cut off. It also makes it easier to supply the troops."

Moltke's conception of battle may be summarized in these words: *immobilize and envelope*. It seemed that he did not have the slightest preoccupation in regard to an inequality of forces, nor seemed at all concerned about the direction of the battle. His strategic role seems to have been achieved after he had succeeded in converging the three armies towards the enemy.

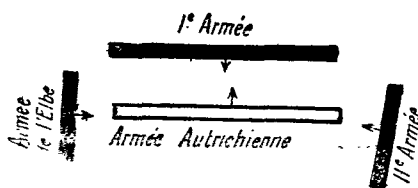


FIG. 5

FORMATION AT THE BATTLE OF SADOWA OR KONIGRATZ [JULY 3, 1866]

1866.—The German concentration took place on the Austrian frontier. The three armies:

- 1st Army: (Prince Frederick Charles), in Lusace.
- 2nd Army: (Crown Prince), in Silesia.
- 3rd Army: (Army of the Elbe\*), in Saxony.

Moltke expected the concentration of Austrian forces at Konigratz, at the turn of the Elbe, and therefore designated this place as the converging point of his three armies.

The function of the 1st Army was plainly indicated, even forced, says the Prussian historian. It consisted in engaging the enemy in battle on the front, of attracting all the enemy forces, and resisting them firmly, in order that the double enveloping attack prepared against the two hostile flanks might succeed.

In fact, the battle was organized, unknown even to Moltke himself by Prince Frederick Charles, who commanded the 1st Army. In his ardor to attack, Frederick Charles did not await the arrival of the 2nd Army and became seriously engaged in battle by eight o'clock in the morning, suffering such enormous losses that King William seriously considered ordering a retreat. Had Benedek† advanced, the Prussians would have been defeated. The advance guard of the 2nd Army arrived at 1:30 o'clock p. m., and at 3:00 o'clock p. m., the Army itself arrived after long marches. Then the result of the battle was decided.

\*TRANSLATOR'S NOTE: The Army of the Elbe was commanded by General Herwarth von Bittenfeld.

†TRANSLATOR'S NOTE: The Austrian Imperial Army, under the supreme command of Benedek stood in a wide semicircle on the upper Elbe.

The bulk of the Austrian Army escaped during the confusion that followed the converging attack of the three armies.

1870.—We still have the three armies:

- 1st Army: Commanded by Steinmetz, concentrated to the North of Sarrelouis.
- 2nd Army: Commanded by Prince Frederick Charles, concentrated to the North of Neunkirchen-Hamburg.
- 3rd Army: Commanded by the Crown Prince, concentrated towards Carlsruhe.



FIG. 6

THE CONCENTRATION PLAN OF MOLTKE IN 1870.—LINE SARRELOUIS-SARREGUEMINES

On August 23, Moltke believed that the French General Staff had decided to maintain the offensive with all available forces at a strong position behind the Sarre (Cadenbronn), to the rear of the line Sarrelouis-Sarreguemines. His plan was again to converge the three armies on this line. "The entrance of these three armies in line, for a decisive battle, is the desired end," he wrote at noon of August 4th to General Blumenthal, Chief of Staff of the Third Army.

On that same day, Moltke outlined the role of these three armies in a telegram to Steinmetz: "The 3rd Army will take the offensive in the Southern region towards Haguenau today, in order eventually to move on to the Upper Sarre; the 2nd Army will continue its movement towards the line Neunkirchen-Hamburg; the 1st Army will receive orders subsequently, either to resist or operate against the enemy left flank. The crossing of the Sarre is not contemplated

before the 9th of August. The adversary seems willing to maintain the defensive behind that river.

In fact, the French forces were not occupying the position at Cadenbronn. The 3rd Army came in contact with MacMahon's army at Froeschwillers, defeating it and pursuing the units that were left in the direction of Luneville. The French main forces withdrew towards Metz. Moltke, in order to prevent the French from escaping to Verdun, surrounded Metz on the south by the 1st and 2nd Armies, which deployed by the right in battle, facing our corps already in position on the heights of St. Privat, to the west of the besieged fortress.

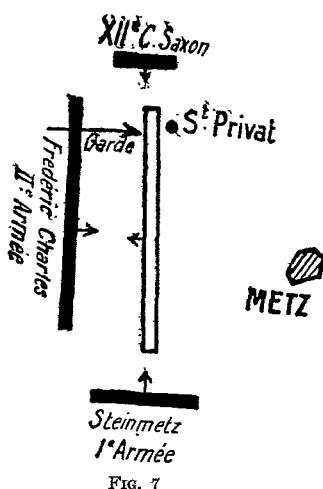


FIG. 7

BATTLE OF PRIVAT [OR GRAVELOTTE] AUG. 18, 1870

The battle was based on one frontal and two flank attacks. The front attack would be delivered by the bulk of the 2nd Army, and the flanking attacks by the 1st Army and by the 12th Saxon Corps of the 2nd Army.

Frederick Charles, desiring to decide the battle by the capture of St. Privat, ordered the Guard to attack, without awaiting for the attack of the Saxons. The Guard sustained enormous losses, and was unable to advance until the arrival of the 12th Corps. The arrival of this Corps diverted part of the forces of the French right, and then, a second attack by the Guard captured St. Privat and decided the battle.

The French troops fell back on the fortifications of Metz.

The battle was, in fact, planned in a Napoleonic manner, by a frontal attack on the flank against which the turning attack of the 12th Corps was directed. This fact passed unnoticed due to the

ignorance that existed at that time in Germany concerning Napoleon's system. The impression that prevailed was that of the Guard's hecatomb in his first attack, and the idea became stronger and stronger in all minds that the break-through of the enemy front was no longer necessary to win the battle, but instead that this would be accomplished by a double envelopment.

At Sedan, MacMahon made no efforts to prevent his envelopment.

**THE BATTLE OF SCHLIEFFEN.**—Schlieffen observed two things in Moltke's battles:

*First:* The enormous losses sustained at Sadowa (or Konni-gratz) by the 1st Army, due to the desire to break through the Austrian front without awaiting for the enveloping attack of the 2nd Army, and by the Guard in the battle of St. Privat, in the first attack, without awaiting for the enveloping attack of the XII Saxon Corps.

*Second:* Insufficient encirclement. At Sadowa, the bulk of the Austrian army had been able to escape. At St. Privat, Bazaine's entire forces had withdrawn to the lines of fortifications. It is true, however, that these were quite close. At Sedan, MacMahon was surrounded, but in truth, the French General had, by his lack of energy, brought it upon himself.

It was necessary to find some other system.

Schlieffen discarded Frederick's system, because it was objectionable in that the adversary might execute the same maneuvers on the opposite flank.

He also discarded the Napoleonic system, whose tricks he did not understand.

As has already been quoted, he writes on this subject: "Napoleon selected his point of attack and there concentrated all his available forces, trusting his success to a heroic, superhuman assault, which would open a gap and overthrow the entire enemy line." He did not believe in the success of such tactics, on account of the enormous losses which modern armies would inflict upon assailing troops.

Schlieffen thought that the weak point of Moltke's battle, both at St. Privat and at Sadowa, consisted in having in charge of the main attack a General like Prince Frederick Charles, who persisted in breaking through without awaiting for the enveloping mass. He also thought that these masses were too weak to effect the envelopment.

A similar plan would be just as disastrous if applied to modern armies. Therefore, it is necessary to adopt an inversion of forces: Reduce the forces assigned to the frontal attack, increasing the enveloping masses. Besides, the progress of arms now permit the economy of forces in this purely demonstrative frontal attack. If the

enemy takes the offensive against this front, it will give in, but not break. And while the enemy, in spite of enormous losses, insist upon forcing the front, the enveloping masses will fall on his rear and catch him in the net.

But this was Hannibal's scheme at Cannae, practically identical to that which Count Schlieffen, Chief of Staff of the German Army, proclaimed for fifteen years. And we may well believe that it had left a deep impression on the German generals in 1914.

"The principle of the Commander in Chief," writes Stendahl, "is similar to that of the three thieves meeting a passer-by at a street corner. What good will the patrol do to the unhappy victim, if it arrives three minutes late?"

This paragraph translated into military language means, that the principle of the Commander in Chief should be to concentrate by surprise a force on the hostile front capable of completely disorganizing it. This attack must be secret and rapid. It is essential that the surprised enemy may not be able to oppose the attacking mass with forces that might cause it to fail.

We have seen the solutions of the great military leaders. That of Epaminondas, at a time in history when the order of battle, once decided upon, could not be modified; that of Puysegur, adopted by Frederick the Great at a time when the order of battle could be modified only with great difficulty. Epaminondas and Frederick made use of quickness and surprise, the latter utilizing the terrain to this effect.

Napoleon's solution while more complex, is more independent of the terrain. It was necessary in order to reap the full benefit of his strategy that the enemy be turned back and the escape of the defeated forces be prevented.

The system of Hannibal at Cannae, adopted by Schlieffen, is based on an idea different from that of Epaminondas, Frederick, Napoleon or Stendahl. It does not aim at making a gap in the enemy front, but at a complete encirclement.

But this encirclement, either presupposes a numerical superiority, or as in Hannibal's case, requires a long stretch of front which would permit the creation of two powerful flanks, even with smaller forces.

We have seen Moltke attacking his adversary with three converging armies, but except at Sedan, these armies did not have sufficient length of deployed front to envelop the enemy. Schlieffen applied Hannibal's solution to modern armies.

We will see in Ludendorff's battles on the Russian front, the results attained by the application of General Schlieffen's doctrines.

# Corps Antiaircraft Artillery on the Defensive

By MAJOR G. A. WILDRICK, C. A. C.

THERE follows a map problem which is self explanatory. It was issued for study by officers of the Second Coast Artillery District during the past winter. Field Orders No. 6, I Corps, and Administrative Orders No. 5, I Corps, can be found in "Tactical and Strategic Studies, Volume I, The Independent Corps," The General Service Schools, Fort Leavenworth, Kansas, 1924. It is noted that the antiaircraft machine guns are assumed to be of .50 caliber.

The solution is a personal one and arrived at independently. This is stressed so that no official sanction can be assumed to be attached. The solution is to the First Requirement only. The other requirements have been omitted.

## GENERAL AND SPECIAL SITUATIONS

The following field orders and administrative orders are issued:

I Corps,  
LANCASTER, PA.,  
4 May 23, 5:00 PM.

FIELD ORDERS }  
No. 6 }

Maps: Geological Survey 1:62500; LANCASTER, NEW HOLLAND, McCALLS FERRY and QUARRYVILLE Quadrangles.

1. *a.* A hostile force, estimated as a corps of two divisions with one regiment of cavalry attached, occupies an organized position extending from the road junction just south of MARTICVILLE, east along the high ground just south of PEQUEA CREEK to hill one mile northwest of HARMONY SCHOOL, with a strong detached post on the high ground about one mile northwest of NEW PROVIDENCE. The high ground southwest of BURNT MILLS is held as a detached post. Enemy covering forces have been driven in on the remainder of the front and our advanced elements are in contact with his main position south of PEQUEA CREEK and BEAVER CREEK. Some intrenching is being done along the ridge: RAWLINSVILLE—TRUCE. Artillery has been located in the vicinity of RISING SUN SCHOOL, SMITHVILLE, and road junction 651 (south of UNION). A division was camped near PERRYVILLE at noon today.

See G-2 Report and special intelligence map of this date. (Omitted)

b. Our army, advancing against the enemy west of the SUSQUEHANNA RIVER, has reached the general line: LONG LEVEL—west to SOUTH MOUNTAIN.

\*NOTE: The orders of the I Corps are quoted from Chapter VIII, "Tactical and Strategic Studies, Vol. I, The Independent Corps." The General Service Schools, Fort Leavenworth, Kansas, 1924, in which may be found additional information as may be desired.

c. The army air service supports the attack of the corps as follows:

- (1) Immediately after dawn the strong point southwest of BURNT MILLS and critical points in the area: MARTICVILLE—RED HILL SCHOOL—hill one mile west of RISING SUN SCHOOL will be neutralized with persistent gas. Gas bombardments will cease on points and at hours prescribed in paragraph 3 d (4).
- (2) Between 4:00 AM and 4:30 AM, the strong point just east of road junction 360, the fortified high ground immediately west thereof, and the hostile artillery in the vicinity of RISING SUN SCHOOL and SMITHVILLE, will be attacked with high explosive bombs.
- (3) After Completion of these missions, the advance of the 3rd Division will be supported by bombing attacks on hostile supports and reserves.

2 a. This corps moves tonight under cover of darkness to assault positions and attacks tomorrow, enveloping the enemy's right flank.

b. Time of attack: 4:30 AM.

c. Line of departure:

PEQUEA CREEK to HERRVILLE—PENNSYLVANIA RR—HERRVILLE to REFTON—LANCASTER and QUARRYVILLE ELECTRIC RR.

d. Zones of action:

1st Division: west boundary: WINDOM (inclusive)—ROCK HILL—CONESTOGA (both inclusive)—road junction 392—MARTICVILLE—BETHESDA (all inclusive).

east boundary: PENNSYLVANIA RR (QUARRYVILLE BR) (inclusive) from LANCASTER to HERRVILLE—BM 345 (exclusive)—RAWLINSVILLE—INDIAN ROCK SCHOOL (both inclusive).

2nd Division: west boundary: same as east boundary 1st Division.

east boundary: GREENFIELD—ROCKVALE SCHOOL—LAMPETER (all inclusive)—crossroads 318—road junction 360—BM 858—LIBERTY SQUARE (all inclusive).

3rd Division: west boundary: same as east boundary 2nd Division.

east boundary: RONKS—road junction 435—OAK HILL—crossroads 738 (all inclusive)—road junction 414 (exclusive)—BM 505—BUCK—LIBERTY SQUARE (all inclusive).

3. a. The 1st Division will make its main effort with its left in conjunction with the advance of the 2nd Division. It will seize in succession, the ridge MARTICVILLE—RISING SUN SCHOOL, the high ground in the vicinity of RED HILL SCHOOL and UNION, and the ridges: MT. NEBO—RAWLINSVILLE.

b. The 2nd Division (less one regiment), making its main effort on its right, will penetrate up the valley of HUBER RUN and, by flanking action up the ravines toward Mt. AIRY SCHOOL, will assist the 3rd Division in securing the high ground east and west of road junction 360 and east of SMITHVILLE, after which it will push on rapidly and seize the HICKORY SCHOOL ridge.

c. The 3rd Division will envelop the right of the hostile position and capture in succession the high ground northeast of NEW PROVIDENCE and in the vicinity of Mt. AIRY SCHOOL, and the TRUCE ridge. It will advance rapidly up the valley of GOLF RUN and will be assisted by the 2nd Division in securing the high ground east and west of road junction 360 by flanking action up the ravines to the west, and in the capture of the Mt. AIRY SCHOOL ridge and the TRUCE ridge.

d. The 101st Field Artillery Brigade will support the attack from the following positions:

101st Field Artillery, vicinity of BAUMGARDNER.

102nd Field Artillery, vicinity of cross roads one mile south of WILLOW STREET.

103rd Field Artillery, vicinity one mile east of crossroads 318 (east of LIME VALLEY).

104th Field Artillery, vicinity of crossroads 449 (one mile south of LAMPETER).

- (1) These regiments will move into positions indicated *via* the road: LANCASTER—WILLOW STREET—BAUMGARDNER, and the road: LANCASTER—CROSSROADS 279—LAMPETER; which will be cleared for their use from 8:00 PM today, until the movement is completed.
- (2) The artillery preparation, in which all guns will participate, will consist of fire on enemy front lines, and on supports and reserves in rear, from 4:00 AM to 4:30 AM. Prior to 4:00 AM, artillery fire will be limited to urgent requirements.
- (3) As its primary mission, the corps artillery will be prepared to concentrate fire on the hostile position immediately east and west of road junction 360. It will also execute counterbattery and such interdiction and harassing fire as will break up enemy concentrations. When not engaged on these missions it will assist the advance of divisions by fire on successive objectives.
- (4) Corps artillery will employ non-persistent gas in counterbattery and to harass enemy reserves along the ravine one-half mile south of the hostile main line of resistance and on the partially organized position along the ridge: MT. NEBO—RAWLINSVILLE—TRUCE. It will also neutralize with persistent gas, beginning at 4:00 AM, the advanced post just southwest of BURNED MILLS and critical points in the area: MARTICVILLE—RED HILL SCHOOL—hill one mile west of RISING SUN SCHOOL.

Gas fire by corps artillery will cease at the following hours:

<i>Area</i>	<i>Non-persistent</i>	<i>Semi-persistent</i>
Along ravine south of hostile main line	4:30 AM, 5 May	(none used)
Along ridge: MT. NEBO—TRUCE	Dependent on advance of divisions	12:00 noon, 5 May

- (5) Division artillery will employ smoke on hostile observation stations in the vicinity of road junction 392, RED HILL SCHOOL, hills in vicinity of RISING SUN SCHOOL, and high ground east and west of road junction 360.

Division commanders, at their discretion, may employ non-persistent gas within their zones of action, coordinating its use with adjacent divisions when used within the danger limits of division boundaries. Semi-persistent gas may be used by divisions on the high ground east and west of road junction 360.

- (6) For other artillery details, see Annex No. 1, Artillery (omitted).

e. The 105th Artillery (antiaircraft) will provide gun area defense along the general line: CONESTOGA—WEST WILLOW—LAMPETER—BUNKER HILL SCHOOL.





[illegible]

- f. (1) The 1st Cavalry (less one troop), with Troop A, 1st Machine Gun Squadron attached, from the vicinity of MT. PLEASANT, will cover the left flank of the enveloping attack, seize hill 804 (one mile north-east of QUARRYVILLE) early on 5 May, and reconnoiter to the south as far as the general line: FULTON HOUSE—KINGS BRIDGE.
- (2) Troop A, 1st Cavalry, will cover our right flank from the vicinity of CONESTOGA, and will reconnoiter to the south as far as PEQUEA CREEK.

g. The air service will support the attack as follows:

- (1) Air supremacy east of the SUSQUEHANNA RIVER will be maintained and hostile aerial observation will be prevented at all costs.
- (2) The corps air service will maintain observation from the initial line: DRYTOWN—BUCK—ROSS HILL SCHOOL to the south. Especial attention to the roads leading north from PERRYVILLE. Three planes will be held available for corps command use.
- (3) Division air services will continue intensive reconnaissance of the hostile position to include the general line: DRYTOWN—BUCK—ROSS HILL SCHOOL. Indications of a Red withdrawal will be reported promptly to the corps.
- (4) The 705th Attack Squadron will be held on the alert prepared to attack hostile supports and reserves.
- (5) The 102nd Balloon Company is attached to the 2nd Division and the 103rd Balloon Company to the 3rd Division for the attack. The Balloon Group (less two companies) will observe for the Corps Artillery, and the 1st Division on call.

h. One regiment 2nd Division, as Corps reserve, will be in readiness after 4:30 AM, in the vicinity of WILLOW STREET.

- æ. (1) All troop movements in preparation for the attack will be made under cover of darkness and all units will be in assault positions by 3:30 AM.
- (2) Every precaution will be taken to prevent the enemy from discovering our dispositions.
- (3) Connection between divisions will be maintained to the right.

4. See Administrative Orders No. 5.

5. a. Axes of signal communication:

I Corps: LANCASTER—REFTON—RAWLINSVILLE.

1st Division: MILLERSVILLE—BURNT MILLS—RED HILL SCHOOL—DRYTOWN.

2nd Division: HOLLINGER—REFTON—HARMONY SCHOOL—SMITHVILLE—HICKORY SCHOOL.

3rd Division: STRASBURG—NEW PROVIDENCE—TRUCE.

b. Command posts:

I Corps: LANCASTER.

1st Division: MILLERSVILLE.

2nd Division: HOLLINGER.

3rd Division: STRASBURG.

By command of Lieutenant General A:

X,

Chief of Staff.

Appendices:

Situation Map, 5 PM, 4 May—following page 108.

Operation Map, to accompany FO No. 6, I Corps, following page 108.

Annex No. 1, Artillery (omitted).

Distribution: (omitted).

I Corps,  
LANCASTER, PA.,  
4 May 23, 5:00 PM.

ADMINISTRATIVE ORDERS }  
No. 5 } To accompany Field Orders No. 6.

1. SUPPLY.

*a. Railheads.*

1st Division: ROHERSTOWN.

All others: no change.

*b. Rations.*

(1) Order of distribution at railhead: no change.

(2) One surgical hospital is attached to each division for rations.

*c. Ammunition.*

(1) Corps park: all classes of ammunition at LANCASTER freight station.

(2) Distribution points for corps artillery: NEW DANVILLE and LONG-NECKER CHURCH.

*d. Engineer.*

Corps park: LANCASTER.

*e. Signal.*

Corps park: LANCASTER.

*f. Medical.*

Corps park: EAST PETERSBURG.

*g. Ordnance.*

Corps park No. 1: LANCASTER—artillery and general supplies.

Corps park No. 2: BAUSMAN—small arms.

*h. Quartermaster.*

Corps field remount depot: SWATARA.

Corps park: general supplies, motor parts and reserve gasoline and oil,  
at bivouac of I Corps Train, ROSSMERE.

*i. Chemical Warfare.*

Refilling point: FRUITVILLE.

*j. Air Service.*

Refilling point: communications zone depot: HARRISBURG.

2. EVACUATION.

By corps.

*a. Men.*

Evacuation point: EAST PETERSBURG..

*b. Animals.*

Evacuation point: DILLEVILLE.

3. ROADS.

*a. Restrictions.*

Corps reserved road, HARRISBURG TURNPIKE, HARRISBURG to LANCASTER.

*b. Maintenance.*

By corps and divisions within their respective areas.

*c. Circulation.*

- (1) Axial road, corps: LANCASTER—WILLOW STREET—road junction 499—REFTON—MARTINSVILLE—NEW PROVIDENCE—QUARRYVILLE.
- (2) Divisions will make mutual arrangements for the control of traffic along boundaries.

## 4. SALVAGE AND BURIAL.

*a. Salvage.* No change.*Burial.*

- (1) Corps cemetery: HOLLINGER.
- (2) Divisions will establish cemeteries.
- (3) All burials will be in cemeteries where practicable.

## 5. BOUNDARIES.

Division rear boundaries: WINDOM—MILLERSVILLE (all to divisions)—BAUSMAN — LANCASTER — GREENFIELD (all to corps) — PHILADELPHIA and LANCASTER TURNPIKE (to divisions)

## 6. MILITARY POLICE.

*a. Traffic Control.*

By divisions within their respective areas.

*b. Stragglers.*

Division straggler lines along boundaries of divisions will be coordinated by divisions concerned.

## 7. PRISONERS OF WAR.

*a. Corps cage:* LANCASTER.*b. Evacuation from divisions by corps.*

By command of Lieut. General A:

X,  
Chief of Staff.

Official:

Y,

AC of S, G-4.

Distribution:

Omitted.

## REQUIRED

1. The formal field order of the commanding officer of the 105th Artillery (Antiaircraft) in compliance with par. 3 *c*, Field Orders No. 6, I Corps.

2. A concise discussion of:

- (a) The proper employment of the 105th Artillery\* in the situation presented.
- (b) Recommendations, if any, for the improvement of par. 3 *c* of Field Orders No. 6, I Corps.

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\*NOTE: The 105th Artillery (Antiaircraft) is assumed to be at full war strength and completely equipped. The machine guns are assumed to be of .50 caliber.

## A SOLUTION

105th Artillery (AA),  
LANCASTER, PA.,  
4 May 23, 7:00 PM.

FIELD ORDERS }  
No. 7 }

Maps: Geological Survey 1:62500; LANCASTER, NEW HOLLAND, McCALLS FERRY and QUARRYVILLE Quadrangles.

1. See Appendix No. 1.

2. This regiment will provide gun area defense along the general line: CONESTOGA—WEST WILLOW—LAMPETER—BUNKER HILL SCHOOL, and will support the corps attack.

3. a. The 1st Bn. (Guns) will support the attack initially from positions in the vicinity of R. J. 398 (1½ mi. N. W. CONESTOGA), C. R. 430 (S. E. of WILLOW STREET) and BUNKER HILL.

Particular attention will be paid to protecting the corps artillery and the corps infantry reserve. Information of friendly and enemy aviation activity over our own troops and over the enemy position will be reported promptly.

b. The 2nd Bn. (MG) will support the attack, employing one battery in each division zone of action. The corps artillery and reserve will be protected and the divisions will be closely covered throughout the attack. Information of friendly and enemy aviation activity over our own troops and over the enemy position will be reported promptly through the nearest A. A. gun battery, with which connection will be maintained. One battery will protect corps headquarters and installations near LANCASTER, and will report aviation activity direct to Hq. 105th Arty.

- x. (1) All movements in preparation for the attack will be made under cover of darkness, and all units will be in position by 3:30 AM.  
(2) Movements within division zones of action will be arranged with the division concerned.  
(3) Every precaution will be taken to prevent the enemy from discovering our dispositions. Observation and photographic missions by enemy aircraft will be prevented.  
(4) Bombing, and other airplanes, attempting to attack our troops, will be driven off.  
(5) All units will be prepared to advance promptly.

4. (See Annex No. 1).

5. a. Battery communications, during advances, will follow divisional axes of signal communication. (See Annex No. 1).

b. Axis of signal communication:

105th Artillery (same as I Corps): LANCASTER—REFTON—RAWLINSVILLE.  
1st and 2nd Battalions: WILLOW STREET—REFTON—HARMONY SCHOOL—RAWLINSVILLE.

c. Command posts:

105th Artillery: LANCASTER.

1st and 2nd Battalions: WILLOW STREET.

X,  
Colonel.

Annex No. 1.

Distribution: I Corps—Corps AS—Corps Chief of Artillery—101st FA Brig.—1st Div.—2nd Div.—3rd Div.—105th Arty. Hq.—Serv. Btry—Hq. Btry.—1st Bn.—2nd Bn.

## ANNEX NO. 1 TO FIELD ORDERS NO. 7, 105th ARTILLERY (AA)

105th Artillery (AA)

LANCASTER, PA.,

4 May 23, 7:00 PM.

1. *a.* A hostile force, estimated as a corps of two divisions with one regiment of cavalry attached, occupies an organized position extending from the road junction just south of MARTICVILLE, east along the high ground just south of PEQUEA CREEK to hill one mile northwest of HARMONY SCHOOL, with a strong detached post on the high ground about one mile northwest of NEW PROVIDENCE. The high ground southwest of BURNT MILLS is held as a detached post. Enemy covering forces have been driven in on the remainder of the front and our advance elements are in contact with his main position south of PEQUEA CREEK and BEAVER CREEK. Some intrenching is being done along the ridge: RAWLINSVILLE—TRUCE. Artillery has been located in the vicinity of RISING SUN SCHOOL, SMITHVILLE, and road junction 651 (south of UNION). A division was camped near PERRYVILLE at noon today.
- b.* Our army, advancing against the enemy west of the SUSQUEHANNA RIVER, has reached the general line: LONG LEVEL—west to SOUTH MOUNTAIN.
- c.* The army air service supports the attack of the corps as follows:
  - (1) Immediately after dawn the strong point southwest of BURNT MILLS and critical points in the area: MARTICVILLE—RED HILL SCHOOL—hill one mile west of RISING SUN SCHOOL, will be neutralized with persistent gas. Gas bombardment will cease on points and at hours prescribed in paragraph 3 *d* (4).
  - (2) Between 4:00 AM and 4:30 AM, the strong point just east of road junction 360, the fortified high ground immediately west thereof, and the hostile artillery in the vicinity of RISING SUN SCHOOL and SMITHVILLE, will be attacked with high explosive bombs.
  - (3) After completion of these missions, the advance of the 3rd Division will be supported by bombing attacks on hostile supports and reserves.
- d.* The air service will support the attack as follows:
  - (1) Air supremacy east of the SUSQUEHANNA RIVER will be maintained and hostile aerial observation will be prevented at all costs.
  - (2) The corps air service will maintain observation from the initial line: DRYTOWN—BUCK—ROSS HILL SCHOOL to the south. Especial attention to the roads leading north from PERRYVILLE. Three planes will be held available for corps command use.
  - (3) Division air service will continue intensive reconnaissance of the hostile position to include the general line: DRYTOWN—BUCK—ROSS HILL SCHOOL. Indication of a Red withdrawal will be reported promptly to the corps.
  - (4) The 705th Attack Squadron will be held on the alert prepared to attack hostile supports and reserves.
  - (5) The 102nd Balloon Company is attached to the 2nd Division and the 103rd Balloon Company to the 3rd Division for the attack. The Balloon Group (less two companies) will observe for the Corps Artillery, and the 1st Division on call.
2. *a.* This corps moves tonight under cover of darkness to assault positions and attacks tomorrow, enveloping the enemy's right flank.
- b.* Time of attack: 4:30 AM.
- c.* Line of departure:

PEQUEA CREEK to HERRVILLE—PENNSYLVANIA RR.—HERRVILLE to REFTON—LANCASTER and QUARRYVILLE ELECTRIC RR.

*d.* Zones of action:

1st Division: west boundary: WINDOM (inclusive)—ROCK HILL—CONNESTOGA (both inclusive)—road junction 392—MARTICVILLE—BETHESDA (all inclusive).

east boundary: PENNSYLVANIA RR (QUARRYVILLE BR) (inclusive) from LANCASTER to HERRVILLE—BM 345 (exclusive)—RAWLINSVILLE—INDIAN ROCK SCHOOL (both inclusive).

2nd Division: west boundary: same as east boundary 1st Division.

east boundary: GREENFIELD—ROCKVALE SCHOOL—LAMPETER (all inclusive)—crossroads 318—road junction 360—BM 858—LIBERTY SQUARE (all exclusive).

3rd Division: west boundary: same as east boundary 2nd Division.

east boundary: RONKS—road junction 435—OAK HILL—crossroads 738 (all inclusive)—road junction 414 (exclusive)—BM 505—BUCK—LIBERTY SQUARE (all inclusive).

3. *a.* The 1st Division will make its main effort with its left in conjunction with the advance of the 2nd Division. It will seize in succession, the ridge MARTICVILLE—RISING SUN SCHOOL, the high ground in the vicinity of RED HILL SCHOOL and UNION, and the ridge: MT. NEBO—RAWLINSVILLE.

*b.* The 2nd Division (less one regiment), making its main effort on its right, will penetrate up the valley of HUBER RUN and, by flanking action up the ravines toward MT. AIRY SCHOOL, will assist the 3rd Division in securing the high ground east and west of road junction 360 and east of SMITHVILLE, after which it will push on rapidly and seize the HICKORY SCHOOL ridge.

*c.* The 3rd division will envelop the right of the hostile position and capture in succession the high ground northeast of NEW PROVIDENCE and in the vicinity of MT. AIRY SCHOOL, and TRUCE ridge. It will advance rapidly up the valley of GOFF RUN and will be assisted by the 2nd Division in securing the high ground east and west of road junction 360 by flanking action up the ravines to the west, and in the capture of the MT. AIRY SCHOOL ridge and the TRUCE ridge.

*d.* The 101st Field Artillery Brigade will support the attack from the following positions:

101st Field Artillery, vicinity of BAUMGARDNER.

102nd Field Artillery, vicinity of crossroads one mile south of WILLOW STREET.

103rd Field Artillery, vicinity one mile east of crossroads 318 (east of LIME VALLEY).

104th Field Artillery, vicinity of crossroads 449 (one mile south of LAMPETER).

These regiments will move into positions indicated *via* the road: LANCASTER—WILLOW STREET—BAUMGARDNER, and the road: LANCASTER—CROSSROADS 279—LAMPETERS which will be cleared for their use from 8:00 PM, today, until the movement is completed.

*e.* One regiment 2nd Division, as Corps reserve, will be in readiness after 4:30 AM, in the vicinity of WILLOW STREET.

4. *a.* Circulation:

(1) AXIAL road corps: LANCASTER—WILLOW STREET—RJ 499—REPTON—MARTICVILLE—NEW PROVIDENCE—QCARRYVILLE.



b. Division rear boundaries: WINDON—MILLERSVILLE (all to divisions)—BAUSMAN—LANCASTER—GREENFIELD (all to corps)—PHILADELPHIA and LANCASTER TURNPIKE (to divisions).

c. Traffic control: By divisions within their respective areas.

5. a. Axes of signal communications:

I Corps LANCASTER—REFTON—RAWLINSVILLE.

1st Division: MILLERSVILLE—BURNT MILLS—RED HILL SCHOOL—DRY-TOWN.

2nd Division: HOLLINGER—REFTON—HARMONY SCHOOL—SMITHVILLE—HICKORY SCHOOL.

3rd Division: STRASBURG—NEW PROVIDENCE—TRUCE.

b. Command post:

I Corps: LANCASTER.

1st Division: MILLERSVILLE.

2nd Division: HOLLINGER.

3rd Division: STRASBURG.

By command of Col. X,  
Y,  
Executive.

Distribution: omitted.

## DISCUSSION OF THE SOLUTION

*Paragraph 1.*—The publication of the information of the situation in an Annex may be considered unique. My reason for it is, in my belief, that literary forms should be adapted to the circumstances—not the latter to the former. In comparison with the other combatant elements of the Corps, the deployment of the 105th Artillery is unique. Take the infantry. As we descend the hierarchy of command we encounter units collected in zones of action of successively decreasing frontages. No such condition obtains for the antiaircraft artillery regiment. It is spread over the entire corps front. We know how difficult are communications within a division. There is no basis for the fond belief that the antiaircraft regiment can establish and maintain a complicated communications net over such a front and for such a depth in a moving situation. Interruptions, sometimes prolonged for hours, must be expected in communications to or from elements advancing with the divisions. Initiative in the lower echelons of the regiment must be relied upon. If sound action is to be expected, the lower commanders must be informed as to what it is all about. Therefore the volume of the information of the situation given in Annex No. 1, including the scheme of maneuver of the corps and the locations of elements to be protected. This necessary information is so voluminous that it would encumber too much the orders of the battalion and lower commanders. The device is therefore employed of putting this information in an annex. The preparation of this annex involves no tactical decision—only tacti-

cal appreciation. A staff officer can edit it and see it through the mimeograph while the field order is being prepared. A glance at the "Distribution" of Appendix No. 1, shows that there is a copy for each officer in the regiment.

*Paragraph 2.*—The mission assigned by the corps establishes the general line of deployment. This is followed out. In addition thereto the regimental commander orders a mobile, offensive form of action in protecting the troops in motion during the attack.

*Paragraph 3a.*—The batteries of the gun battalion are given general locations which will conform to the corps order. The positions selected are on high ground which will permit freedom in observation and pointing. The general locations should assure the following:

a. Fire support against enemy airplanes until our divisions have passed the first enemy organized position.

b. Avoidance of conflict with corps artillery positions and probable positions of divisional artillery and reserves, and appropriately distant therefrom for efficient fire action.

c. Driving off enemy airplanes attempting to bomb our troops. By their changes of position and utilization of concealment, the divisional elements should secure an appreciable degree of immunity against bombing. Also, these units can be protected closely by the machine guns of the antiaircraft artillery which will keep the bombers at appreciable altitudes. The corps artillery and the corps infantry reserves are the principal agencies of the corps commander for influencing the attack. The security of these elements should be assured. The corps artillery, particularly, moves with some deliberation. It must be expected that the enemy, by aerial observation, flash ranging, or sound ranging, will detect ultimately the positions of this artillery. A bombing attack, directed with definite precision against these objectives, or counter battery, can then be expected. In order that the corps artillery may occupy its initial emplacements as long as may be desirable for our purposes, and in order that its freedom from molestation may be protracted, enemy bombers, enemy air observers, enemy aerial photographers must be driven off or kept at such altitudes as to destroy their efficiency. Therefore the gun battalion is informed as to the choice of targets it should make in the event of a simultaneous, yet diverse, enemy aerial concentration.

d. Ready establishment and maintenance of signal communications.

e. Rapid forward displacement.

f. Supply and evacuation.

The observation of, and reporting, friendly and enemy aerial activity is an important duty of aircraft artillery. Ground observation of the air is in some important respects even superior to that of aerial observers. Besides that, it is a decided advantage to our air service if this observation can reduce the wear and tear on our airplanes and reduce the exhaustion of our pilots and observers which are occasioned by the maintenance of air patrols. While an enemy airplane operation may be completed *in this small area* before the anti-aircraft artillery reports can be transmitted to our air service, yet such reports should provide important information from which our air service can deduce probable enemy aviation intentions. Moving, as they will, with some deliberation in protecting the corps artillery, the gun battalion should be able to provide the principal portion of this observation and should be able to maintain a good standard of communication for the rapid transmission of this combat intelligence.

*Paragraph 3.*—Three machine gun batteries are allocated at the rate of one per Infantry Division area and one to protect corps installations at Lancaster. The general reason for pushing three of them forward, is to have guns immediately present and available to destroy or nullify enemy airplanes which may attempt to observe, machine gun, or bomb our divisional troops from the lower altitudes. A question is whether those three batteries should be “attached” rather than that they should be placed “in support.” There are good arguments for either organization. One of the principal reasons for attachment is that the rapidity of aircraft maneuvers will prevent much central fire control, and therefore a great decentralization of execution must be effected even down to platoons; and that, in view of the foregoing, the division commanders should control these batteries in the divisional areas. Where divisions are in detached positions, the force of that reason is increased. In the situation here presented, however, the divisions are concentrated in the attack, and the batteries will be close enough together to permit of an appreciable degree of coordination of observation, movement, and supply by the battalion commander. Also the corps infantry reserve and the corps artillery and balloons must be protected, and they are not under divisional command. Details of execution can be left largely to the machine gun battery commanders who should keep in touch with divisional commanders and respond to local calls for protection. Decentralization of execution can be secured in this organization also. Having the batteries “in support” in this situation is preferred for the following three reasons:

*First:* The air cannot be divided into “zones of action.” The air in the general vicinity of the combat area must be viewed as a single area.

*Second:* Surveillance of the air should be maintained as much as possible by antiaircraft artillery personnel, and the combat intelligence so obtained should be transmitted promptly by the regimental headquarters to the corps air service headquarters. The antiaircraft artillery should therefore be kept under regimental command in this situation, both for necessary disposition of armament and observation, and for the maintenance of the organization of communications and of intelligence.

*Third:* The corps artillery, with attached balloons, and the corps infantry reserve should be protected under the control of the corps commander. The employment of some machine guns should be coordinated intimately with the guns for this purpose.

The mission to the machine gun battalion may be considered indefinite as to the extent of the division between the protection to be given the corps artillery and reserve, and that to be given to the Infantry Divisions. This may be a very important defect if the regimental commander stays in his command post back at Lancaster and if the machine gun battalion commander is without initiative; otherwise the defect should not be of any importance. The battalion commander, in his order, may prescribe the number and locations of platoons from each battery to protect the corps artillery and infantry reserve, and may prescribe what strength will advance in close support of the infantry. These actions he should follow up.

The regimental commander should inspect the dispositions and make desirable modifications.

The observation and reporting of aviation activity is a normal function of all antiaircraft troops. A question here arises as to the routing of the reports from the machine gunners. It would appear futile to tell the battalion to establish a complete separate net. Each division in its limited zone of action will have enough of a job to do that. It would be impossible for the machine gun battalion, with its limited means, to do it in a moving situation over a corps front. The maximum we can hope for it that one telephone line to the nearest gun battery can be extended and maintained as each machine gun battery headquarters moves forward.

A criticism may be aimed at the employment of only one machine gun battery to protect corps headquarters and installations at Lancaster. In reply, it is my belief that the fight will be won by the divisions and corps artillery and corps reserve, not by the installations in rear. Therefore the bulk of the antiaircraft artillery should be well forward to cover the decisive areas.

Another question is how the machine gun battalion commander is going to exercise command. I believe he can keep general track of the locations of each battery headquarters through the connec-

tion to the gun batteries. I visualize for him a roving commission, with special emphasis on the coordination of the action of his batteries along the boundaries of the 2nd Division.

*Paragraph 3, x, (1).*—This is merely in conformity with the corps order.

*Paragraph 3, x, (2).*—This may appear to be an indefinite arrangement. Under the limitations of the time and circumstances, I cannot see what more can be done. I believe that division commanders will give reasonable assistance in traffic control so as to assure the movements. It is to their own advantage. Furthermore, a study of the basic text shows that the machine gun companies have been previously attached to the divisions during the advance, and so an appreciable degree of mutual understanding will have been developed by this time.

*Paragraph 3, x, (3).*—The first sentence is in conformity with the corps orders. The last sentence gives the special mission of the antiaircraft artillery to promote, within its special power, the desire of the corps commander.

*Paragraph 3, x, (4).*—This is an appropriate, general directive.

*Paragraph 3, x, (5).*—This is to assure readiness for prompt movement.

*Paragraph 4.*—Pertinent provisions of the corps administrative orders are published in the annex. The selection has been made with a view to the wide frontage of the regiment and the decentralization of arrangements, necessitated for movements, both for the initial deployment and during the attack.

*Paragraph 5a.*—The purpose of the directive is to organize the laying of lines along prescribed routes. I visualize the following resulting net:

Lines will be run along the divisional axes of signal communication. The gun batteries will connect laterally to these. The lines will be extended forward to machine gun battery C Ps as they advance. When the gun batteries make a forward bound, they will connect laterally to these lines. As the battalion command posts make a bound forward, they will have a line or lines laid laterally connecting to the axial lines, and thereby to the gun batteries, and through the latter to the machine gun battery C Ps.

#### IN CONCLUSION

Is the 105th Artillery on an offensive or defensive mission in this situation?

The question may be cleared up by an inspection of the action of the other troops on the field. There is only one kind of soldier present (excepting the small amount of cavalry) who can capture

and hold—he is the infantryman with a rifle and bayonet. There is your only Simon pure offensive element. What is the role, in the last analysis, of machine guns, tanks, artillery, air service? Their role is to defend the rifleman from interference during the advance: They defend by beating down enemy infantry fire, artillery fire, and other measures taken against our riflemen. The antiaircraft artillery beats down enemy aerial attempts against our riflemen and supporting arms.

Machine guns, tanks, air service, artillery, antiaircraft artillery, do their particular forms of damage with the same tools and with the same projectile effects on any sort of an occasion, be it so called “offensive” or “defensive” action. The essential distinction between their “offensive” and “defensive” action consists in whether the rifleman is attempting to “capture” or whether the rifleman is attempting to “hold.”

Like the other troops, excepting the rifleman, the 105th Artillery is on the offensive in this situation simply because the riflemen are on the offensive.

It is my belief that the antiaircraft artillery is not exclusively a defensive arm any more or less than any other kind of artillery or supporting arm.

#### ROBERT E. LEE

“Read and re-read,” said Napoleon, “the eighty-eight campaigns of Alexander, Hannibal, Caesar, Gustavus, Turenne, Eugene and Frederick. Take them as your models, for it is the only means of becoming a great leader and of mastering the secrets of the art of war.” To that select band of great commanders the name of Robert E. Lee must be added. His exact precedence among them I will not attempt to determine, but that they have received him as a soldier worthy of their fellowship I do not doubt.  
—Major General Sir Frederick Maurice, in *Robert E. Lee The Soldier*.

# EDITORIALS

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## Military Reading

RECENTLY there appeared in one of the service publications a most interesting account of an investigation carried on by a regimental commander in which it developed that of his fifty-seven officers, only four were reading books, outside of those that pertained to their daily routine of work, that dealt with the military profession.

These figures do seem startling, but it is to be remembered that the time of the regimental officer is pretty fully occupied each day and that the very nature of his work requires that he do considerable reading in order properly to perform his duties and to hold his own in the competition for place—a competition that exists in the Army just as in any other walk of life. However, the officer who is satisfied just to hold his own is not apt particularly to distinguish himself during his military career. Personality, tact, judgment, initiative, self reliance are forces that wage a powerful influence in determining the degree of success an officer may attain; but another and most important factor is interest in one's profession and knowledge of the same. This interest and knowledge can be secured and maintained by an officer only by discussing his daily work with his brother officers, by imparting what he already knows to others, and by reading and studying.

The JOURNAL would like to suggest a course of reading of some of the text books used at the Coast Artillery School and General Service Schools, but after a long day of hard work it takes more determination than most of us have to read such books an hour or so each evening. Anyway, the time will come when every officer will gain a close acquaintance with the contents of these books, and thereafter, unless the lessons contained therein are to be forgotten, he will have to review these studies frequently, not necessarily by actually studying the same books, but by reading and digesting the activities and campaigns to which they apply.

It is held that the broad principles of military strategy have not changed in the past two thousand years. This probably is true, but

methods of waging combat change greatly with each succeeding war; therefore no matter how deeply one may investigate the campaigns and wars of Napoleon, conceded by practically every military writer to be the greatest captain of all times, he cannot from these studies alone form a conception of a future war. To form such a picture it is necessary also to study the campaigns of recent wars, particularly those of the World War, for it is proverbial that every war commences about where the last one left off. In addition to these a study of the biographies of military leaders is of interest and great value, for human nature changes but little and the problems confronting a leader a hundred or fifty years ago are similar to those facing leaders today, and the mental processes by which the problems are solved are very much the same.

With the foregoing as an argument the JOURNAL ventures to suggest that officers will find the following list of books interesting as well as profitable reading. Undoubtedly other and better books could be suggested, but these have withstood the test of time, or in the case of the more recent publications, have been most favorably reviewed. The reading of such books will of course suggest others to be read, the net result being that the reader's interest in his profession will be augmented, his knowledge of military affairs broadened, and his value as an army officer greatly increased.

Stonewall Jackson and the American Civil War. By Colonel G. F. R. Henderson. Published in 1903. This book is regarded, both in America and abroad as one of the finest military biographies ever written.

Turn of the Tide. By J. C. Wise. Published in 1920. An accurate account of the early American operations in France. Those described are the battles of Cantigny, Chateau-Thierry and the Second Battle of the Marne.

1914. By Field Marshal Sir John French. An account of the British Expeditionary Forces in France from the outbreak of the World War until May, 1915.

Principles of Strategy. By Colonel W. K. Naylor, U. S. Army. Published in 1921. Written by one of America's foremost instructors in strategy and military history. The book is replete with historical illustrations.

Napoleon, An Outline. By Brigadier General C. R. Ballard, British Army. Published in 1924. A concise appreciation of the military genius of Napoleon, as seen by a British-writer. The book presents the history and strategy of Napoleon's campaigns in such a way as to be easily understood by the general reader.

Robert E. Lee the Soldier. By Sir Frederic Maurice. Published in 1924. An account of the Civil War campaigns of General Lee. Written by one of the world's foremost military writers.

The History of Tactics, by Captain A. F. Becke, British Army. Published in 1909. The author was for many years an instructor in British military schools. Discusses the history and development of tactics from 1740 to 1905. Replete with historical illustrations.



War According to Clauswitz. By Major General T. D. Pilcher, British Army. Published in 1918. A summary of Clauswitz's "On War," written in a manner easily understood.

Gallipoli Diary. By Sir Ian Hamilton. Published in 1920. An account of the landing on and occupation by the British forces of the Gallipoli Peninsula.

The Strategy of the Western Front. By Colonel H. H. Sargent. Published in 1920. An analysis of Germany's strategic operations and the plans of the Allies by which they were countered.

The defense of London. By Colonel A. Rawlinson. Published in 1923. A presentation of the tremendous problem that had to be met in building up the anti-aircraft defense of London.

My Campaign in Mesopotamia. By Major General Sir Charles V. F. Townsbend. An account of the first British Expeditionary Force in Mesopotamia. Written by its Commanding General. It is unique among narratives in that the author gives a concrete statement of the basic principles of war and shows how he tried to apply them.

Battle studies. By General A. C. DuPicq. First published in 1870. This book stands alone as a study of the psychology of the soldier in battle. A military classic known to every French officer.

From Private to Field Marshal. By Field Marshal Sir William R. Robertson. Published in 1921. An account of the military career of the only man who ever climbed from the very bottom to the highest grade in the British Army. Written by himself. In the World War General Robertson was Quartermaster General, and later Chief of Staff of the British Army in Belgium; Chief of the Imperial General Staff; and Commander-in-Chief of the forces in Great Britain.

## A New Editor

Major Robert Arthur, C. A. C., has been detailed Editor of the *COAST ARTILLERY JOURNAL* and is to assume his duties prior to the appearance of the September number. Everyone acquainted with Major Arthur will realize that the *JOURNAL* is being entrusted to a very able officer. He is a graduate of the United States Military Academy, class of 1907; a distinguished graduate of the Coast Artillery School, class of 1912; a graduate of the Advanced Course, Coast Artillery School, class of 1924; and a distinguished graduate of The Command and General Staff School at Fort Leavenworth, class of 1925. He has been awarded the Distinguished Service Medal for exceptionally meritorious and distinguished services rendered in France during the World War. The War Department order conferring the Medal on him states in part: "He commanded the 121st Field Artillery during the Aisne-Marne, Oise-Aisne, and Meuse-Argonne offensives with distinction. In addition he served as chief of heavy artillery of the 57th Field Artillery Brigade in those offensives. His high professional skill, sound judgment, leadership, and devotion to duty were material factors in the successful operations of the artillery forces with which he served." Not only do his educa-

tional qualifications fit him for his new detail but in addition he is recognized as an artilleryman of unusual merit. His writings on artillery subjects have appeared frequently in the pages of the JOURNAL, have always been based upon sound premises, and have often been used as lesson assignments by the Coast Artillery School. It is certain that the JOURNAL will be of unusual interest and value during the regime of Major Arthur.

### Spotting

A bulletin issued April 6, 1925, from the Office of the Chief of Coast Artillery, states: "It is essential that spotting sections be so thoroughly trained that battery commanders can rely upon the data furnished them and make the adjustment corrections without hesitation, as soon as the spotting results are received." The question of spotting is one with which every battery commander is intimately concerned. He realizes that a satisfactory practice cannot be carried out without accurate and rapid spotting data. No standard spotting system has yet been adopted, and battery commanders have therefore improvised methods for determining the location of the fall of their shots. This has resulted in a great deal of thought being given to the principles of spotting, and to the mechanical devices involved. A universal spotting system for the Coast Artillery Corps will some day be accepted as standard but it is necessary meanwhile to proceed cautiously in order that such a system when adopted may prove satisfactory for many years. It is believed Lieutenant C. E. Brand, C. A. C. has expressed some very sound thoughts on spotting in an article that appears in the Professional Notes Department of this issue of the JOURNAL. It is invited to the attention of anyone seeking information upon this subject.

### Teamwork in National Defense

There is a striking similarity in the relations that should exist for national defense between our harbor defenses and the navy, and between anti-aircraft and the air service. Suitable defenses for our harbors will permit our fleet to exercise its proper mission—that of seeking out the enemy fleet and destroying it, or of keeping the ocean lanes open for our commerce. Without harbor defenses there would be an irresistible demand by our coast cities that a suitable number of warships be maintained in each of these harbors, in order to guard them from enemy raids. Such a disposition of our fleet would be disastrous to the proper functioning of the navy.

Similarly, if entire dependence were placed upon our Air Service to protect vulnerable points such as shipyards, powder works,

petroleum reserves, concentration camps, railway terminals, cities, and important bridges, the Air Service would be so split up and tied down that its greatest asset, mobility, would be largely neutralized. While antiaircraft artillery has a well recognized and indispensable mission as a component of corps and larger units in the field, it has just as important a mission in the defense of such vital localities. A few guns placed about each of these will furnish reasonable security from air attack, and will permit our planes to be concentrated at the larger fields and available in quantity for instant service. Both antiaircraft artillery and the air service are essential to the nation's scheme of defense, but there is a well marked line between the missions of the two.

## The Lessons of 1918

*[Reprinted from the CHICAGO TRIBUNE.]*

General Bullard's memoirs of the late war continue to furnish food for the serious thought of the American people and especially for those in authority.

For example, we suggest that there be set off against the perpetual propaganda of the opponents of preparedness his remarks on the condition of our army in the crucial month of the great German drive to break apart the British-French line. That was in March, 1918, virtually one year from our declaration of war and the first mobilization of our military forces.

This year had been spent in strenuous preparation, and yet not even one division was fit to take a place in battle without the aid of French officers, French organization, and French equipment and supply. Gen. Bullard is by no means inclined to underestimate the merits of his famous division or their progress in preparation, but any intelligent reader must be impressed with the significance of his frequent references to the overseeing, tutelage, and aid of the French.

His officers and soldiers of the line could fill in the story with staggering effect. General Bullard gives only the larger outlines and makes the best of what was a serious situation. We should be the better for even more candor, for the whole picture, in vivid detail, of our army's unpreparedness.

No one who realizes the complexity and scale of modern war will harshly blame our men for their mistakes or limitations. They were men, brave and devoted men, not gods or demigods, and they paid a ghastly price. But the real fault lies with their nation and its governments, year in and year out, who refused to face facts and make intelligent preparation against eventualities.

And now, despite the rough lessons of actual experience, we are back again in our pleasant illusions. The pacifist and the shortsighted devotee of mistaken economies are shaping our policies precisely as before the sanguinary days of 1918. Then, fortunately for our honor and our cause, we had the seasoned armies of our allies to hold back the enemy and bear the brunt of the onset. That is not likely to happen again. Yet we manufacture patent formulae for eternal peace and drift toward disaster.

It behooves all officers of whatever grade to fit themselves, by unceasing thought and study, for the exercise of command. No one knows how soon his services may be urgently required in defense of the country. Much can be learned from an intelligent study of military history, and no one can be too well prepared for the great responsibilities of war. It is well to remember, in the course of our work of preparation for tomorrow, that principles do not change, though the method of their application is ever changing. No matter how much the machinery of war may be developed in the final analysis, it is the man we must understand. Man, with all his strength and all his weaknesses, always has been and always will be the basic element, and it is the knowledge of his psychology that we must master when we consider how his best efforts may be developed in war.—Major General Hunter Liggett in *"Commanding an American Army."*

# PROFESSIONAL NOTES

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## Spotting

By 1ST LIEUT. C. E. BRAND, C. A. C.

The Naval War College considers fire at large ships at beyond 21,000 yards *ineffective*, less than two per cent hits being expected. At 25,000 yards only three per cent hits are expected. It appears highly probable, therefore, in spite of the somewhat greater accuracy of the fire of seacoast guns, that a battery firing at beyond 25,000 yards range would expend its entire battle allowance of ammunition and its accuracy life without doing any vital damage to its target ship. This would indicate that effective firing at battleships and therefore effective position finding and spotting in seacoast actions must be done within 25,000 yards range. It is not that our guns are useless beyond this range. It has been demonstrated that a large city may be hit by cannon fire at a range of 76 miles—but not a moving battleship. The idea is visionary at least.\* And even if such fire at naval targets (with destructive effect) were possible the fact remains that our present position finding service and most of our guns do not range beyond 25,000 yards or thereabout, and our present need is for a spotting service to match.

Upon the basis of the above and of certain other more or less obvious necessities in spotting, we may now formulate some basic specifications for a satisfactory spotting service:

- (1) It must cover the area covered by the position finding service of the battery.
- (2) It must be as dependable as the position finding service and must function with it.
- (3) It must be quick in operation and give accurate results (at least within a probable error—the more accurate the better).
- (4) It must not prevent the effective functioning of the position finding service of any battery.
- (5) It must be able to single out the particular impacts of shots of a particular battery, disregarding all others.
- (6) If designed for more than one battery it must be able to spot many shots at near the same time.
- (7) It should be able to furnish deviations from the point on which the gun was laid (the setforward point) rather than from the actual position of the target at the instant of impact.
- (8) It should be a permanent standard installation. In view of its great importance in adding to the effectiveness of the millions already spent on armament, an outlay of a few thousands for satisfactory instruments which may be

\* It has been gratifying to note since this was written that the War Department has in Provisional TR 435-20 stated this matter plainly, pointing out that unless naval forces were conducting a long range bombardment of a city, naval facilities, etc., the batteries would *not open fire* beyond 20,000 yards except to establish the range, which corresponds closely with naval doctrine. To quote from the above TR, "when the enemy has entered the 4th sub-area (15,000-20,000 yards) the time has arrived for the defenses to engage capital ships seriously." Fire beyond that range is a special case of more moral than material importance. It is not, however, entirely negligible.

necessary is not objectionable. For the same reason the technical staff of the Ordnance Department should perfect the design of and manufacture any such instruments with any necessary materials which may be bought on the open market at reasonable prices or obtained otherwise practicably—not the company mechanic with odd pieces of brass and scrap lumber.

Specifications (1) and (2) suggest strongly that the spotting system should be bound up with the position finding service. These important, *necessary* requirements are thereby assured; however there must be no conflict with specification (4). Specifications (1) and (2) also suggest, and (5), (6), and (7) practically require, that the spotting shall be done individually by each battery and not by central spotting agencies for groups of batteries. Coast Artillery Memorandum No. 1 in fact now places the responsibility for spotting with the individual battery by not allowing time out for slow spotting in the rating of the battery. Under this hypothesis specification (6) would be no longer necessary. However the advantages of centralized spotting merit further consideration which will be taken up later.

Specification (5) may be accomplished through utilization of the time of flight and the scant possibility of absolute simultaneity of impacts of shots from unrelated batteries. This is done successfully in the navy by use of a clock which is set at the time of flight, is started like a stop watch at the firing of the guns, and rings three second-bells, (just as our observers use the time interval bells) to indicate the instant of impact, which occurs on the third bell. The instrument for this purpose has therefore already been devised. For coast artillery purposes it should be graduated so as to be set in range (instead of time of flight) for any particular battery. By means of this instrument spots from air observers may be identified in the same manner, the air observer calling "splash" or making a buzzer signal at the instant he observes the splash and adding the spot immediately thereafter. In a general action these signals (with accompanying spots) would follow each other with such rapidity and irregularity that it would probably be necessary to utilize several observers operating on the same wave length. However each particular battery should be able to distinguish its own data by the signal immediately following the third stroke of its splash clock. It will be necessary in such a case, also, to refer all spots to some normal G.T. line which may require a conversion of coordinates for some batteries in case the armament is dispersed laterally an appreciable amount as compared with the range.

If, as suggested above, the observing stations of the battery are to be the spotting stations it is obvious that some form of bi-lateral spotting must be used. Moreover it is sound that both of these services should use the same stations and cables since one service is useless without the other, and therefore by separating them the chance of the battery being put out of action by the disability of one of them is doubled. If it may be argued against such combination that there exists some special vantage point for spotting in some particular case, it is also a fact and to the same extent that it is a special vantage point for position finding. All arguments of this nature must obviously apply equally.

Such a vantage point does in fact exist for lateral spotting in that all or practically all coast artillery batteries have one observing station at or near the battery. Lateral angular deviations from the target may therefore be directly observed and measured without difficulty and under satisfactory "service" conditions from this station. Even though such station be several hundred yards from the directing point of the battery the measured angular deviation of the splash as viewed from it is sensibly the same as the lateral deviation from the gun-target line. This is not true of the corresponding azimuths. Such deviations may also be measured satisfactorily from the setforward point with the present equipment and without interference with the position finding service. It in fact has been done with entire satisfaction. The spotting problem which remains unsolved is therefore one of longitudinal deviations. And in this problem advantage may and should be taken of the fact mentioned above that one observing station may

be located at or near the battery. The exceptional case where this is not true, however, should not be ignored in either lateral or longitudinal spotting.

Longitudinal deviations may be measured from bi-lateral observations in general in two ways: (1) by measuring the range to the target (or setforward point) and the range to the splash or impact at the instant of impact and taking the difference; (2) by measuring directly the longitudinal distance between the target (or setforward point) and the point of impact. It is obvious that since the first method involves more or less independent measurements of large quantities, the difference between these measurements is much more susceptible of error, and susceptible of larger errors, than if the difference were measured between two visible points directly as such. Without further consideration, therefore, other factors being equal or nearly so, we should adopt the second method. In other words the observed quantities from each station should be not azimuths of target and of impact, but the *angular displacement of impact with regard to target*. This condition, however, presents itself only when the deviation is to be measured from a material target. And this, we have seen, is of no direct utility as a basis of fire adjustment corrections unless the position of the target at the instant of impact is known to coincide very approximately with the setforward point selected by the plotter, and this cannot be expected except in the conventional target practice. And when the deviation is to be measured from the setforward point, itself, as must be done in the usual case, there is obviously involved in determining the azimuth of the setforward point from the spotting station, and setting it on the spotting observer's instrument the inverted process of an independent plot (the unavoidable errors of which it was sought to avoid by basing the measurement upon an observed *deviation*) and all the errors of separate measurement are reintroduced. In order that this may be clearly seen it is necessary to anticipate certain points which are to be discussed later. In particular, suppose that the telescopes of the spotting observers are to be set upon the setforward point by bringing up the B' and B'' arms of the plotting board upon the targ before it has been removed from the setforward point and transmitting the azimuths read to the respective spotting observers at these stations. Consider the spotting instruments thus set in azimuth and the arms and targ still in place on the plotting board. Now clearly the spotting instruments are set upon the real setforward point by exactly the same error by which the plotted point would be in error were the process considered reversed. The plotted position of the splash which follows must be identical whether the reading by which it is determined is taken from the azimuth scale or a deviation scale. As for accuracy there is therefore no choice, when spotting is done on the setforward point, whether the two points are each determined independently and their difference then measured, or whether one point is plotted with respect to the other by means of a measured angular deviation. Tentative provision should therefore be made for both methods of determination until some other consideration in the completed system of spotting may place one method or the other at a comparative advantage.

The problem has now narrowed itself down within workable limits. It may be stated in two parts: (1) by use of the present observing stations (positions) to measure accurately and rapidly either (a) azimuths of impacts, or (b) angular displacements of impacts from target; (2) from these measurements to determine accurately and rapidly longitudinal linear displacements of impacts from target along the gun-target line. To take up these parts of the problem in the order named, it appears at once that either aspect of the first may be readily accomplished by the use of any azimuth instrument with a splash scale such as, for example, those with which our present B. C. telescopes (Model 1910) are equipped. A more satisfactory form is the glass cell carrying both cross wire and splash scale marked upon it, the latter on its lateral diameter (such as B. C. telescope Model 1918, except that graduations should be in degrees and hundredths instead of in mils). Better than either of these is a French observation telescope of which there are a few in our service equipped with such a splash scale, though unfortunately without a pointer, and with 15-, 23-, and 30-power eye pieces so

mounted that either may be turned into position for use in an instant. The particular superiority of this instrument for the present purpose lies in the fact that it is equipped with two independent traversing knobs and scales. One scale is normally set at zero. This scale is graduated and numbered in both directions from zero: right, red; left, black; and is provided with a subscale to give readings of the finest accuracy as well as instantaneously. The second scale is the ordinary azimuth scale, which is oriented so that the instrument reads correct azimuths with the first scale set at zero as indicated. The target is followed in the ordinary manner by traversing the instrument on the azimuth scale (or the azimuth of the setforward point is set on this scale when spotting is done on the setforward point). At the instant of impact this traversing stops, and the cross wire is turned instantly upon the splash by means of the first knob. The observer calls *right* or *left* according as the splash is in the *red* or *black* part of his scale—the actual right or left—and glances at his scale to add at once the exact amount in hundredths, which should be done within two seconds after the splash. There is no time lost in estimating the nearest graduation, which makes for accuracy and positive certainty as well as speed. It must be added that these instruments are at present graduated in mils. This should be changed to degrees and hundredths, as all the standard coast artillery instruments are graduated, and other slight modifications made to make what has been said above strictly true. The addition of a splash scale pointer would also increase its usefulness, since this would permit small deviations being read directly from the splash scale. It should moreover be mounted upon a pedestal for complete stability, which it lacks upon the tripod mount. This instrument with the proposed modifications completely and thoroughly solves the first part of the spotting problem, namely the effecting of rapid and accurate measurements of azimuths or angular deviations as viewed from the observing stations. Any extra telescope with a splash scale, even the observer D. P. F., would be a possible alternate or emergency instrument for this purpose, provided that such use of the D. P. F. did not interfere with its primary function.

The remaining part of the spotting problem is now restated (2) given the accurate angular deviations of the splash from a target point of known range and azimuth from the battery, measured from stations of known positions: to determine accurately and rapidly the longitudinal deviation of the splash from the target point with regard to the battery. Since the plotting board is our most familiar instrument for solving such problems it at once suggests itself. With the arms set accurately on the setforward point their intersection is the point from which measurement should be made. By moving each of them right or left the amount of the deviations called off by the spotting observers the point of impact is determined and may be accurately targeted; or, as noted above, the point of impact may be located with equal accuracy by plotting it directly by its azimuth from the two stations. The longitudinal distance between these two points measured directly to the scale of the board is the deviation required. Adaptations of this method have frequently been attempted without particularly good results either as to rapidity or accuracy. The practical difficulties to be encountered and effective means of overcoming them are as follows:

(1) If spotting is to be done with reference to the target, it is necessary that the target be plotted simultaneously with the splash. This is obviously impossible. If one is plotted by deviations immediately after the other, with present equipment, the time consumed and errors introduced are prohibitive. Such spotting as is contemplated here must therefore be done on the setforward point, which is indeed the desired end. But this necessitates a determination of azimuths of the setforward point from both spotting observers and its transmission to them in order that their instruments may be properly set in case the impact is to be plotted from a measured deviation. And these azimuths are not ordinarily determined in drill. This could easily be done, however, without inconveniencing the position finding service in any way, by the use of a duplicate plotting board. Such a duplicate board in fact exists in many batteries, and its existence is



assumed as a necessity in the following discussion, whether the impacts are plotted by deviations or by azimuths. The gun-armsetter of the duplicate plotting board, or spotting board, is connected by telephone on the regular B' reader-armsetter line so that he hears the true azimuth of the setforward point from the battery called off and sets it on his own arm. Similarly the spotter is connected by telephone with the Pratt Range Board operator or some corresponding number who calls off the true range of the setforward point. The spotter upon hearing this range targs the setforward point, and the gun arm is cleared. The setforward point is now located on the second plotting board, or spotting board, and if its azimuths from the B' and B'' stations are desired the B' and B'' arms are

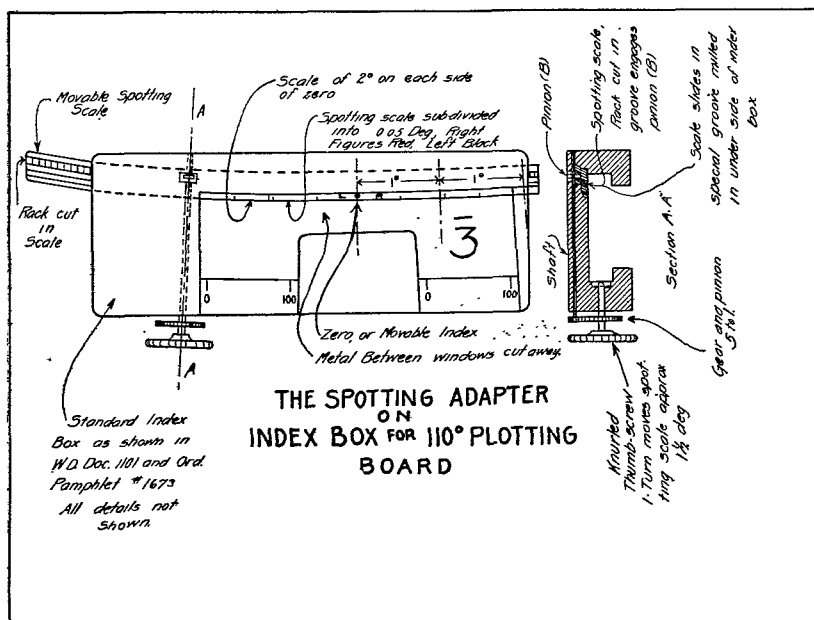


FIG. 1

**AUTHOR'S NOTE:** This modification of the index box on the 110° board (as well as the apparatus shown in the other figures) was designed by an ordnance officer skilled in such work. And its utter simplicity and effectiveness strikingly illustrates the point made elsewhere in this article that designing is not the work of a layman, but of an expert. The operation is as follows: after the arm has been set up on the targ, as described in the text, the movable index (i. e. the index of the movable spotting scale) is set by means of the knurled thumb screw on the nearest even degree of the azimuth circle. Thereafter when the "spot" is received, it is set so much right or left from this even degree directly on the spotting scale by moving the arm right or left the required amount.

then brought up against the targ and the azimuths read off to the spotting observers who are connected by telephone with the B' and B'' armsetters. The angular deviations of the splash from the setforward point, or simply the azimuths of the splash, are called back by the spotting observers over the same lines, and the measured longitudinal deviation called off by the spotter to the Pratt Range Board operator or corresponding number who applies the necessary fire adjustment correction.

(2) The scales and means of setting the arms of the plotting board are not adaptable to accurate and rapid "right" and "left" settings of odd amounts from given odd azimuths (in case spotting is to be done by deviations). This cannot be remedied without modifying the sub-scale on the arm by adding a movable part to it. There is no difficulty in making this change, however, and the movable

index would have considerable utility in position finding as well as in spotting if employed on the gun arm for setting azimuth corrections. Improvised devices for this purpose have in fact been proposed. A very simple modification of the index box of the 110° board is shown in Fig. 1.\* This would be still more simply accomplished on the gun arm or on the arms of the Cloke board. By means of this simple modification it will be seen that a scale of the index box may be set at zero regardless of the position of the arm, so that any position may be taken as a reference point and any desired setting made right or left from it, within limits of two degrees.

It might appear that since the point of impact may be determined with the same degree of accuracy by simply plotting it from its observed azimuth as by plotting it from observed deviations, there would be no occasion for transmitting the azimuths of the setforward point to the spotting observers. However, at this point there occur several considerations which argue in favor of spotting from deviations instead of from azimuths. First, in a general engagement it will as a rule be far simpler to give the spotting observers certain azimuths and direct them to read a splash occurring in their fields at a given instant than to attempt to keep them (in addition to the regular observers) constantly on target. Second, the splash will as a rule be nearer the setforward point than to the target, and therefore more certainly in the field of the observer if set of the setforward point than if tracking the target. This is particularly true in cases where spotting on the setforward point is of most value. Third, deviations can be much more quickly read than azimuths. In fact the spotting observer would probably require a reader if azimuths were required, just as in the case of the regular observers. The azimuths of the setforward point should therefore in all cases be transmitted to the spotting observers and set upon their instruments. Their observations may then be made either as azimuths or deviations, and deviations appear best with the modified index to permit their setting. It should be noted also that the entire process of transferring the setforward point to the spotting board, reading the azimuths on the B' and B" arms, transmitting them to the spotting observers, and setting them upon their instruments, is done with great deliberation, the time being ample, and should accordingly be accomplished with a high degree of accuracy.

(3) The longitudinal deviation of the plotted splash, which is coupled with a certain amount of lateral deviation, cannot be readily or accurately read from a random section of any of the arms or scales of the plotting board. A separate and special scale must be used for this purpose. On account of the lateral deviations this scale must take the form of a rectangularly ruled grid, or at least a grid with one central line-of-sight ruling and parallel rulings perpendicular to the line of sight to read hundreds of yards and subdivided by finer lines to read twenties of longitudinal deviations. This grid should be ruled upon a semi-transparent substance such as xylonite, and the "over" and "short" sides of the median line should be of different colors. There should be a sharp pin-point under the center of the grid to place in the targeted setforward point and another very short pin-point on the end of the line of sight toward the battery to hold it fast in direction when oriented. The grid must be thin and its edges beveled so that the arms of the board may pass over it without catching.†

—The entire spotting procedure is then as follows: The gun-armsetter sets the gun arm at the azimuth of the setforward point as described above. The spotter makes a short pencil line of direction along the gun arm and targs the setforward point at the proper range. The gun arm is cleared and the spotting grid carefully placed in position. The targ is now placed on the setforward point as marked by a sharp prick point hole in the exact center of the grid and the B' and B" arms brought up carefully against it. There will be small danger of moving the targ by bringing the arms up against it with its point set in the

\* See accompanying note for explanation.

† See Fig. 2 and Note. There are certain minor variations from the above description which may be noted.

hard substance of the grid. The azimuths are read off to the spotting observers as described above. The splash clock, per specification (5), properly set in range, is started by the gun-armsetter with the firing of the gun, and the armsetters call "one, two, splash!" to the observers with the bells. The angular deviations (or azimuths) are called off by the observers and set on the arms as described above and the resultant point of impact targed. Immediately when the armsetters have called "set" the spotter calls "over" or "short," as the case may be, which is the armsetters' signal to clear, and adds at once the exact amount, interpolating to the nearest ten yards on his grid. Targing the point and reading the deviation could not consume more than two seconds. It is believed that by this system of spotting the deviation report should be in the hands of the man who applies the correction within an average time of five seconds after the splash. In cases where the B' station may be made the directing point

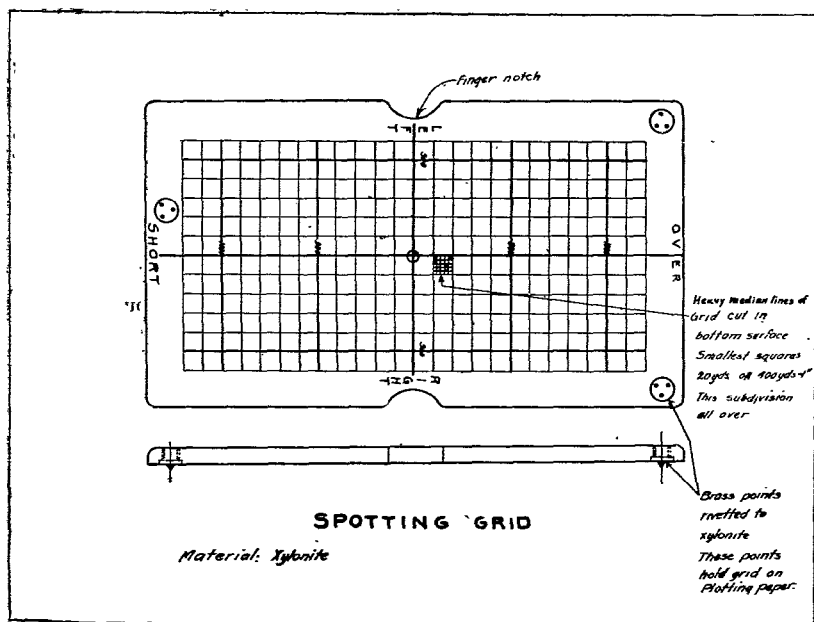


FIG. 2

**AUTHOR'S NOTE:** This spotted grid is designed to be set on the setforward point and the line of orientation by fine lines on its under surface. By this means perfect coincidence is assured, the spotter having ample time to check his setting. The grid graduations proper, upon which the deviations are read, are cut in the top surface of the grid to facilitate reading. Pressure upon the grid after it is set imbeds its three points into the board, insuring its immobility. This construction is slightly different from that suggested in the text.

of the battery, which is possible in nearly all gun batteries, the entire system, as well as the position finding system, is greatly simplified by the elimination of the B' arm. It may be added that approximate spotting on the target may be done by setting the grid at the approximate target position—the nearest even degree is fairly accurate—and measuring the angular deviations from the target as described under the discussion of the observation telescope above. This is in every way less desirable than accurate spotting on the setforward point and will not commend itself to persons well grounded in the principles of position finding and fire adjustment.

This system of spotting is particularly applicable to batteries already provided with two spotting boards since in this case the only alterations necessary

are the addition of movable indices on the arms,\* which increase the usefulness of the boards for plotting as well as for spotting in case it should be desired at any time to interchange the two or use an alternate system for either. The grids are very simple, but should be made with great care to insure accuracy. In quantity production the cost of each should be very small. Observation telescopes for the spotting observers, and their telephone lines, are essential. The telescope described above is by far better than the ordinary azimuth instrument, if deviations are to be measured, though the latter might be used successfully at the B' station, especially if it were also the B. C. station. One "splash clock," as it has been called, should be provided for each spotting section. No wiring for it is necessary. To operate this complete spotting apparatus requires two observers, one spotter, and three (or two) armsetters. The duplicate plotting board with the usual necessary telephone connections is of course essential. The cost of the entire installation including telescopes, movable indices, spotting grid, and splash clock, but assuming the duplicate plotting board and spare lines in important cables for the spotting observers, should be well within the value of one or two rounds of target practice ammunition, depending upon the gun served.

The spotting system described above, as has been noted, is not universally applicable for the reason that all batteries do not have two plotting rooms. Even for batteries which do have two plotting rooms an alternate set of plotting and spotting equipment will materially increase the fighting efficiency of the battery. The second plotting board, equipped as described above, will serve as both if an additional spotting device is provided. In constructing an entirely separate spotting device it may or may not be most effective and convenient to follow the pattern of the plotting board. Obviously the course of the target and the broad area of the board have no significance in spotting as they do in plotting. In fact all that is used of the board in spotting is the intersection of the arms and the area usually within less than a thousand yards radius of this intersection. If a device can be made of no greater area than this it will have obvious advantages of great importance, particularly as to room for its installation in batteries already constructed and, of equal importance, its portability in case of mobile units in coast and field operations. Moreover it would be possible in such a case to use a much larger scale for the device which would make for greater simplicity as well as for finer accuracy. It therefore becomes expedient to consider the possibility of constructing such a device.

Assuming a mechanical solution similar to that of the plotting board it is obvious that the center of the area upon which the solution is to be performed should be the point upon which the fire is to be adjusted if this area is to be a minimum. It is equally clear that the minimum area which could be used would be the rectangle or "oval" of dispersion of the gun plus a liberal allowance for initial correction which should not exceed a thousand yards. Assuming a maximum accidental error of the piece of 1000 yards, the area of our device should therefore be a circle of 2000 yards radius. The actual size would of course depend on the scale used, but should not be more than 20 inches in radius (at 100 yards per inch), which is a generously large board. Assuming a maximum deviation of 1200 yards (initial plus accidental) and a scale of 200 yards per inch the radius of the board is reduced to six inches, a conservatively small size. An effective board might be still smaller, but these appear practical limits.

The problem to be solved by this device is essentially the problem solved by the plotting board. The lines of direction from the observing stations to the point upon which the gun is laid must be represented by lines intersecting at the center of the board. The lines B'-splash and B''-splash must be represented by other lines intersecting at a second point. The component of the deviation of this second point from the first parallel to the line of fire must be measured. Since the first point is in fact the center of the board, the lines which determine

\* These are not necessary if spots are to be made from azimuths of splash.

it have no direct utility and may be disregarded. However, the second point, which it is the function of the board to locate, is determined by the B'-splash and B"-splash lines, and these must therefore be capable of instant and accurate determination upon receipt of the angular deviations reports. It does not appear practicable to locate this point on such a board from azimuths of the splash. Since, however, it has been shown that the spotting observers should be supplied with the azimuths of the setforward point in any event for purposes of identification and to insure the splash being in the field of view, there is involved no greater difficulty of any kind in plotting the splash by its deviations. This may be done in general in two ways. The first is by actually representing to scale, off the board, the B', B'', and battery positions, pivoting long arms at these

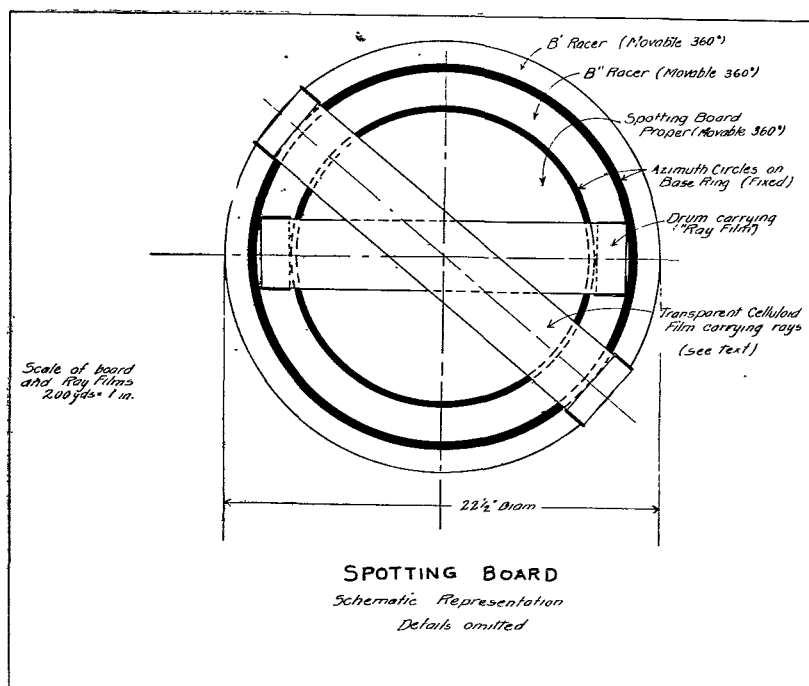


FIG. 3

positions, and keeping the whole system oriented to the principle of the Cloke plotting board. A device of this sort was proposed and described by Major Q. Gray in the *COAST ARTILLERY JOURNAL* a few years ago.

The second method of effecting the solution is by limiting the device strictly to the board used, determining the data for the necessary orientation of the lines of observation from other sources. This orientation consists in causing the lines B'-target and B"-target to intersect at the proper angle at the center of the board and in determining the segments of the lines B'-splash and B"-splash which intersect on the board. The first part of this orientation, namely causing the B'-target and B"-target lines to intersect at the proper angle, is easily accomplished by use of the azimuths of the target from the stations. For obviously the required angle of intersection at the target is the difference between the azimuths of B' and B'' from the target, and these in turn are the back-

azimuths of the target from the stations. Since only the angle of intersection is required it will be more convenient to set the azimuths direct instead of the back-azimuths, the intersection being identical. Therefore if the circumference of the spotting board is graduated in degrees and the B'-target and B''-target lines set in azimuth on it from the center of the board the proper intersection of these lines is thereby affected. The determination on the board of the line segments representing the lines of observation to the splash and whose intersection is the point whose deviation from the center of the board is to be measured is not so simple. Since the distance of the line segment B'-splash from the line segment B'-target is at any point a function of the range of the target from B' as well as of the angular deviation of the splash from the target, the ranges B'-target and B''-target as well as the azimuths must necessarily be used in this determination. Inasmuch as this particular requirement of the spotting board furnishes a crucial test of the proposed system of spotting which employs it, it may be well to pause here to completely visualize the problem to be solved.

If from a point there is drawn a flat pencil of rays at .05 degrees apart covering, for instance, two degrees on either side of a median line and extending indefinitely, it may afterwards be graduated to any linear scale desired. The farther the rays are extended the more they diverge. However the *angular* distance between two adjacent rays is always .05 degrees. Since the tangent of one degree is .01746, or in other words a degree subtends  $1\frac{1}{4}$  inches at 100 inches, such a pencil would be  $3\frac{1}{2}$  inches wide at 50 inches and seven inches wide at 100 inches. The .05° rays at these distances would be about  $\frac{1}{23}$  inch and  $\frac{1}{12}$  inch apart respectively. This segment of the pencil from 50 to 100 inches might conveniently represent the ranges 10,000-20,000 yards, the usual spotting ranges at the scale of 200 yards to the inch. The same segment might be made to represent the ranges 5,000-10,000 yards at 100 yards to the inch by setting half the range on each according to the first graduations, and so on indefinitely for still smaller or greater ranges. We may think now of the B'-target and B''-target lines as the median lines of such pencils. Upon the spotting board, then, proper segments of these two pencils, according to the range on each, are set with their median lines to intersect at the proper angle, as described above. The problem is now to pick out the particular ray of each pencil which contains the splash, to note the intersection of these two rays, and to measure the deviation of the point so determined from the center of the board according to the scale used. This is the *picture* of the problem. It may or may not be expedient to actually draw the pencil segments about the median OT lines. But they must in any event be conceived there, and the proper rays whose intersection is the splash must be actually and accurately determined.

As was noted above, any ray segment in the vicinity of the target is determined by two known conditions (expressed in mathematical language), namely (1) the angular deviation of the splash from the target (the required ray segment containing the splash), and (2) the range to the target along the OT line. This implies that the perpendicular distance of the ray segment from the target point is determined as the product of the range (along the OT line) by the tangent of the angular deviation, and that its slope or inclination to the median line is determined directly by the angular deviation which is in fact the angle of inclination of the ray segment to the median line of direction whatever may be its distance from this line, i. e. independent of the range. The segment is therefore determined by (1) locating on the perpendicular to the OT line through the target point a point the proper lateral distance from the target point, and (2) setting the ray segment through this point at the given inclination to the median OT line. The second operation means setting a second point on the ray segment upon a given scale graduation—that is, upon a second given point. Since the ray is therefore necessarily determined by two points it is practically expedient to determine points on the ray at successive ranges—say at 2000 yards apart—as the first point was determined. A straight edge set upon two of these points will then determine the required ray segment. The ray segment contain-

ing the splash from the second pencil is determined in the same manner, and the targed intersection of the straight edges is the point of splash whose deviation from the center of the board may be readily called off at a glance. This has been done practically in the Cole spotting board, which is perhaps the most successful spotting device so far constructed. General familiarity with this device is assumed, since it has been described in the COAST ARTILLERY JOURNAL, and it will therefore not be discussed in detail. Attention is invited, however, to the facts that (1) the instrument is crude, in the mechanical suspension of its moving parts, and, in particular, in that the end points of the rays, as described above,

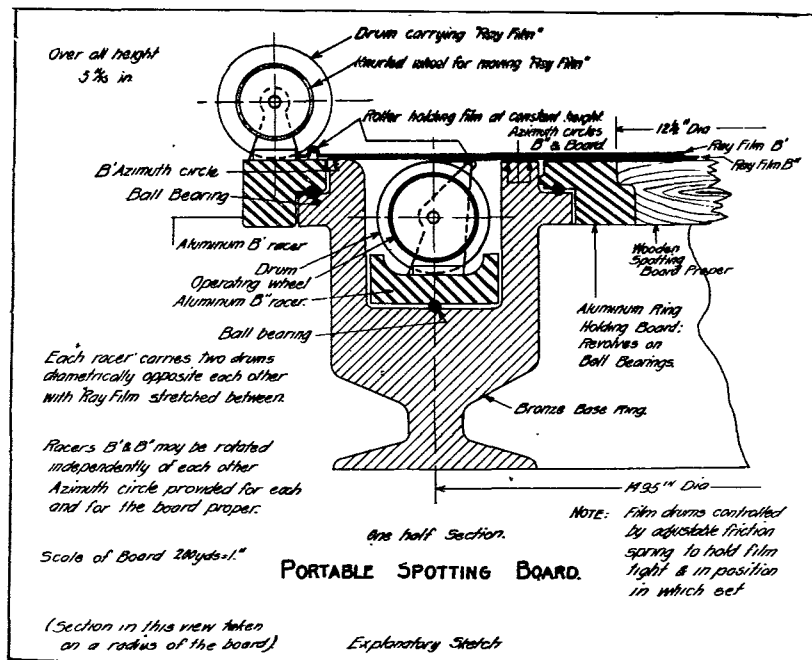


FIG. 4

**AUTHOR'S NOTE:** These diagrams are purposely made to explain construction and operation rather than to serve as a machinist's "working diagrams," though they are drawn to scale (note dimensions), and it would be a simple matter to dimension them in detail and further detail component parts, specify materials, machining operations, etc. It will be noted that the large racers used in this construction make for a particularly high degree of accuracy as well as for great stability and durability of construction. Judging from the size of this diagram it is evident that the scale of the board might be doubled, if desired, and its other dimensions increased accordingly, without materially affecting its portability.

are contained on movable cylindrical paper scales, and (2) data must be set on it by four separate individuals all of whom must call "set" before the spotter can targ his point. The first defect, that of crudeness, may be minimized by careful construction and by using a large scale. A part of it, however, is inherent in the device. The second consideration is more seriously detrimental to both speed and accuracy. In addition to the large size of the detail, from a viewpoint of trained personnel required, four settings mean four chances of error and the multiplication of four small "accidental" errors in exact settings. Though the simultaneity of the settings saves time, the fact of four individuals further weakens the accuracy and certainty of operation of the device. Moreover the

four settings cannot be checked as "set" simultaneously, so that some time is lost. We should therefore expect only fair results at best and at times quite erratic results with this device under average conditions. Such were the actual results with one used during the past season though the board was made by a skilled ordnance machinist and was operated throughout the season by one officer personally, the observers also being officers in the case of some firings. The system suffered somewhat from lack of proper observing instruments, though this was corrected by use of the observation telescope described above in the latter firings of the season. It must be added, too, that the results, though sometimes erratic, as stated, were nevertheless better than those gotten with the non-service make-shifts which have been employed heretofore. And the introduction of this device marks a distinct epoch in artillery firing methods. It is a mark of progress from target practice to real artillery firing. However the device is not entirely satisfactory for the reasons stated and for the additional reason, which has not been discussed, that the system of using it has not been fitted smoothly into the drill of the battery which it is serving. Before taking up this matter, however, another method of solving the spotting problem itself will be considered.

There were considered above narrow pencils of rays which were conceived as surrounding the OT lines. Let us now actually construct such pencils on long narrow strips of transparent celluloid such as photographic film. The lines should be made very fine, photographically, and each  $.25^\circ$  line should be heavier to facilitate reading. On the right of the median line the rays should be red, on the left black. The value of the  $.25^\circ$  rays should be indicated in figures at short intervals. Now consider each of these pencils wound upon two spools, a middle portion of about 2500 yards being between the two spools in each case. The two spools for each pencil are mounted rigidly at this distance apart (the secondary being somewhat longer than the primary) and the units so formed pivoted at the center of the board so that the pencil segments may be moved freely in azimuths, the intersection of their median lines remaining at all times the exact center of the circular board. Figs. 3 and 4 (q. v.) show this mounting detail. One spool of each pair should contain a spring to keep the film taut, and the other should be equipped with a knob by which the film could be wound from one spool to the other with changes in range. The spool with the knob should move with sufficient friction to stay set in any position. The secondary unit is sufficiently longer than the primary that each moves in azimuth entirely free from obstruction of the other so that their median lines may be set in coincidence or at any angle of intersection desired. The board itself is scaled into a rectangular grid such as has been described above, except that in this case there is no need for transparency. It should be conspicuously colored and marked to facilitate reading and to distinguish at a glance "overs" and "shorts." This can be done by different colored graduations, indicating on either side of the heavy zero line the "overs" in bright yellow-orange, for instance, and the "shorts" in blue (these colors not being easily confused with the red and black of the ray pencils). These graduations should be finely drawn and shaded in the usual manner to indicate hundreds and fifties. The scale may be further accentuated by coloring the bands 0-100, 200-300, 400-500, etc., "over" pale yellow and the corresponding bands "short" pale blue, leaving the intervening bands white, and writing the value of the bands in large outlined figures in the center of each in the appropriate color. This great amount of detail may seem trivial. But it is usually details, even trivial ones, which make the difference between success and failure. The ease of reading a scale, however, particularly in such a case as this, is not trivial, but of vital importance. Around the circumference of the board is a fixed azimuth circle. The board is mounted to rotate within this circle and carries a pointer to its inner limb. The rotating pencil segments, as described above, carry pointers to its outer limb, each limb being graduated in proper orientation.

The board is located in the plotting room near both the plotting board and the range or elevation correction board. When the setforward point has been



targed its range and azimuth are called off in the usual way and the range set by the spotter on his splash clock. The B' arm is brought up (as it is brought up now on the predicted point in many mortar batteries where the B' station is the BC station) and the range to the nearest hundred is called off by the plotter as a signal to the armsetter to "read." The armsetter thereupon calls off the azimuth exactly.\* The spotter sets both these data on his B' pencil segment as they are called and repeats the azimuth by telephone to the B' spotting observer, who sets his instrument accordingly. The B" arm is brought up almost simultaneously in the same manner. The B' arm having been "cleared" as its azimuth was read, the B" arm is trued on the targ and its range and azimuth called off and set in the same manner as the B' data. The spotter calls "one, two, splash!" with the bells, his attention focussed upon the B' pencil. The B' spotting observer calls "right" or "left" so much (ex. "right twenty-five"), and the spotter sets a xylonite straight edge which he holds in his left hand upon that ray, repeating "right twenty-five" and shifting his attention to the median line of the secondary pencil. The B" spotting observer thereupon calls "in" or "out" so much (ex. "out sixty-five") according as the splash is on the inshore (battery) side of his OT line or on the outshore (away-from-the-battery) side of it. The spotter runs his targ or pencil "in" or "out" along the straight edge to the proper ray and, shifting his attention again to the conspicuously striped and colored grid, calls out "over" or "short," and, looking more closely, adds the exact amount to the nearest ten yards. The entire process should be completed within five seconds after the splash.

This board should be made according to a standard design and with the usual finesse of fire control instruments to insure accuracy. In particular the ray pencils must be mounted to rotate about the exact center of the grid, flush with its surface, and with just enough friction to remain set in any position. The practical details of the design should be worked out and perfected by skilled ordnance officers and machinists to whom such matters are routine. There could certainly be no difficulties encountered in attaining the ends indicated.† A scale of about 200 yards to the inch would appear most convenient. The main scale of the pencils could cover the ranges 10,000-20,000 yards as suggested above, or might be extended to 25,000 yards if thought necessary, considering the difficulty of making the pencils. In case difficulty is encountered in making these ray films as long as suggested they may be shortened by using a reduced longitudinal scale, the rays in this case becoming curves instead of straight lines. Of course this involves a small error due to the curvature between the intersection of the median lines of the pencils and the point of splash. For example, if the longitudinal scale is one-half the lateral scale and at range  $x$  a splash occurs 500 yards over, the divergence of the rays of the pencils at that point is correct for range  $x$  plus 1000 instead of  $x$  plus 500 as it should be, and the error is that which would have resulted from setting the range 500 yards in error on pencils drawn to full scale longitudinally. This error is relatively small for the average deviation (averaging perhaps 5% to 10% when cumulative for the two pencils) and might be outweighed by considerations of simplicity in making the scales. However, such an error should be avoided if at all practicable. Plain paper grids should be supplied for spotting above or below these limits to the smaller or larger scale. These lower scale grids may also be conveniently used to further speed up adjustment corrections by using the half, third, or fourth scale grid, etc., for the second, third, or fourth shot; the spotter, instead of calling "over" or "short" so much, calling "down" or "up" the amount his scale reads, in accordance with the method of fire adjustment employed. An assistant spotter would be definitely required in this case.

The advantages in the operation of this spotting device are obvious. The most important are: (1) it requires but one operator in addition to the spotting observers, although an assistant spotter may be used if available and desired.

\* A slide rule may be used instead for this operation, as discussed later.

† See Note, Fig. 4.

(2) Everything is "set" *before* the splash. After the splash the operator has but to locate the intersection of two rays already drawn and set on his board and call off the deviations determined thereby on a conspicuous scale already in place. (3) Since the pencils and grid are constructed with absolute accuracy (within possibilities of reading) there can be *no error whatever* (within practical limits) in the computations made by the board. Spotting data determined by this board should be practically accurate within ten yards. (4) Finally, as has been mentioned, the data should be called off to the range correction board operator within five seconds after the splash. The obvious advantages of installation, namely small size and consequent ease of mobility, have been commented upon.

The disadvantage in the use of this system of spotting is the inconvenience to the plotting detail in supplying the necessary orientation data. It will be remembered that specification (4) above required that the spotting must not prevent the efficient functioning of the position finding service. This system requires that two extra sets of readings be taken on the setforward point in addition to those taken on the gun arm. This will require perhaps an average of five seconds more time. Any plotting section which can drill passably can perform the ordinary operations on the plotting board within 15 seconds. Supplying the spotting data would therefore lengthen this time to 20 seconds, which would leave the plotter but 10 seconds to draw in lines of direction and estimate the future course of the target. A good plotter with good armsetters would have more time, and for a good plotter the 10 seconds would be sufficient, particularly since these spotting data are only supplied for bells on which shots are fired. But if the time should be insufficient in any particular case it would not materially affect the accuracy of the data nor to any great extent if any the rapidity of fire to lengthen the observing interval 30 to 35 seconds. In cases where the B' station is the directing point of the battery, which should be the case whenever possible, only the B'' spotting data in addition to the regular firing data are necessary. This is simpler than determining the azimuth of the predicted point as is done at present in all mortar batteries, since it is not necessary to move the targ. Of course in mortar batteries this must be done *in addition* to determining the azimuth of the predicted point. Finally, if this disadvantage prove to be a serious one it may be entirely removed by use of a slide rule which converts range and azimuth from directing point to setforward point (taken directly from the plotting board) to range and azimuth from the spotting station. Such a slide rule may be made universal and accurate within .02 degrees in azimuth.\* In range such accuracy is not required. In this case the spotter transmits to the spotting observers the uncorrected range and azimuth of the setforward point as called off from the plotting board. Each observer works out his own range and azimuth, sets his instrument, and reads the orientation data for the spotting board back to the spotter, who sets it. The deviations are then sent at the proper time as described above. The use of this slide rule would probably require an assistant for each spotting observer.

In case the spotting is done on the target instead of on the setforward point, which is but a rough process at best, even if the actual deviations are determined to the yard, it is sufficiently accurate to keep the ray pencils set by azimuths read to the nearest degree from time to time by the spotting observers—for instance immediately after the shot is fired. The ranges can be set to the nearest thousand yards by data from the plotting board. This, of course, does not inconvenience the plotting section in the least. The accuracy of the spotting data even with the approximate settings should be within 20 yards. However, since this deviation is measured from the point at which the target happened to arrive at the instant, it may differ widely from the true deviation from the point on which the gun was laid.

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\* The description of this slide rule cannot be undertaken here. A working model has been made, however, and is now in process of revision toward greater simplicity of operation.

If the deviations are measured from the target, moreover, one spotting system may be made to serve several batteries simultaneously. In order to accomplish this result under service conditions, however, the firing of each battery must be made to follow a definite schedule. Such a scheme has been proposed by H. H. Blackwell. It provides that all firing data be computed for the successive predicted points (which means a marked simplification of the plotter's work) and that the device which corresponds to the splash clock supply the gun commander with proper firing bells, which must naturally vary with the time of flight. In accordance with this system the splash must always occur *on the T. I. bell*. There could therefore, according to this system, be no better spotting observers than the regular B' and B'' observers with their D. P. F.'s equipped with splash scales, the observer calling off the deviation of the splash while the reader calls off the azimuth of the target. The matter of selecting the proper splash when several batteries are firing is thus reduced to its simplest form (the T. I. bells of the several batteries not being in synchronism) and the entire spotting detail reduced to one man. This is the case whether multiple spotting is used or not. But, as stated at the outset, only under this system or a similar one can spotting be conducted for more than one battery at a time. According to this system six different guns or batteries could easily be accommodated by setting their T. I. bells 10 seconds apart according to a definite schedule. This system of firing on the predicted point simplifies both plotting and spotting, whatever system of either is used. The simplified system of spotting described in this paragraph, however, it must be remembered, is seriously defective in that it refers deviations to the target rather than to the setforward point. Its great simplicity commends it, nevertheless, as an emergency method in the case of reduced trained personnel, and this consideration alone warrants the equipping of all D. P. F.'s with splash scales and pointers. The flexibility of fire control switchboards in all up-to-date coast defenses at the present time would permit the necessary alteration in telephone connections without difficulty.

We shall now summarize the several points which have been developed in connection with spotting, and state in more or less succinct form decisions reached and conclusions drawn from the discussion as a whole. In the first place we have noted that there is at present a vital *necessity* for a standard and effective *service* system of spotting for artillery fire, with the necessary instruments for its installation. Since position finding and spotting are always conjointly necessary and mutually coordinate and interdependent, economy, simplicity, and security demand that the two should be bound together into one composite system, each battery being served by its own system which may be temporarily or permanently assigned to it. This implies a standard system of bi-lateral spotting to correspond with the plotting system now in use. The maximum effective range of this composite system is 25,000 yards, which is practically covered by the present position of finding service. Fire beyond this range is a special problem of relatively minor importance to be solved in cooperation with the air service. The interests of accuracy demand that the solution of the spotting problem be based upon observed angular deviations (not azimuths) of the splash as viewed from the observing stations. Correct adjustment of fire demands that the deviations be measured from the setforward point instead of from the target. According to the present system of drill these deviations cannot as a rule be measured on the observers' D. P. F.'s, even if the instruments were equipped for this purpose. However, for emergency use and use with different systems of drill the D. P. F.'s should be provided with a splash scale and pointer. There should be provided as regular equipment for the spotting observer a special observation telescope which has been described in some detail above. Its essential features are two independent traversing knobs, with proper scales, and a finely graduated splash scale and pointer. These instruments should be supplied to all batteries at the rate of one per observing station (or per D. P. F.). An extra telephone is necessary from each instrument to the switchboard. There are prob-

ably sufficient spares in the cables already laid to accommodate these instruments. However in the future allowance should be made for them.

The simplest device for effecting the solution of the spotting problem from either azimuths or observed deviations of the splash is an extra plotting board from zero or normal in addition to the simple fixed subscales provided at present. All arms of plotting boards should be provided with movable index boxes of this character in addition to the simple fixed subscales. They allow greater flexibility in position finding as well as in spotting. In addition a simple spotting grid such as has been described above should be supplied for each plotting board used for spotting purposes. In order to take care of the case of batteries which have but one plotting board, and in order to provide an alternate plotting and spotting board for batteries which have two plotting boards, a second spotting device must be devised. Since the plotting board, considered as an additional installation, possesses disadvantages of large size and small scale, great weight and consequent limited mobility, and all the concomitant inconveniences of these characteristics, a new spotting board should be devised which contains the essentials of the plotting board but eliminates the unessentials. The essentials are the intersecting OT lines, which are represented on the plotting board by the fiducial edges of the arms, and an area of perhaps 1200 yards radius (to a convenient scale of perhaps 200 yards to the inch) around their intersection (the target point) upon which the spotting problem may be solved. A practical but imperfect solution of this problem has been reached in the Cole spotting board. A more effective solution consists in a somewhat similar mounting upon transparent celluloid film actual ray pencil segments surrounding the OT lines, with provision for their proper orientation, so that an impact may be located at once as the intersection of two rays already set before the splash. The deviation of the splash from the target point is read at once from a conspicuously graduated grid similarly set before the splash. The details of this device and its use are described above.

Each battery then has as its spotting equipment the following:

Observing Instruments: *Regular*: Special observation telescope per observing station, with telephone line switchboard. *Emergency*: Regular observer's D. P. F. equipped with splash scale and other pointer.

Spotting Boards: (for batteries with two plotting boards) *Regular*: Second plotting board equipped with movable index boxes on arms and with spotting grid. This board can furnish accurate spotting data from the setforward point only. *Alternate*: (*when second plotting board is used for position finding, or when emergency demands*) Portable one-man spotting board described above. This board has the necessary flexibility for any kind of spotting.

Spotting Board: (for batteries with one plotting board) Portable one-man spotting board described above. It may be used with either regular or emergency observing.

Splash Clock: One per battery, as described above.

This equipment supplies every battery with an effective regular and emergency service spotting system which can furnish accurate spotting data measured from either setforward point or target under all conditions under which the battery's position finding service can operate, and within five seconds after the splash. It requires a minimum of one, an average of three or four, and a maximum of six operators, including observers.

### Changes In Designations Relating to Coast Defenses

Paragraph V, of General Orders No. 13, War Department, June 9, 1925, is of such vital interest to Coast Artillerymen that it is here published in order that it may be available for ready reference:

1. To the end that the designations of units comprising the fortifications of the United States may be more truly descriptive, and that they may more nearly

conform to the terms used in other branches of the service, the following changes therein are made:

a. The principal harbor defense tactical and administrative unit, heretofore designated the "Coast Defense Command," will hereafter be known as the "Harbor Defense," the commanding officer of such a unit will be called the "Harbor Defense Commander," and his staff the "Harbor Defense Staff."

b. The unit heretofore designated the "Fort Command" will hereafter be known as the "Fort."

c. Units heretofore designated the "Fire Command" and the "Mine Command" will be known as the "Group."

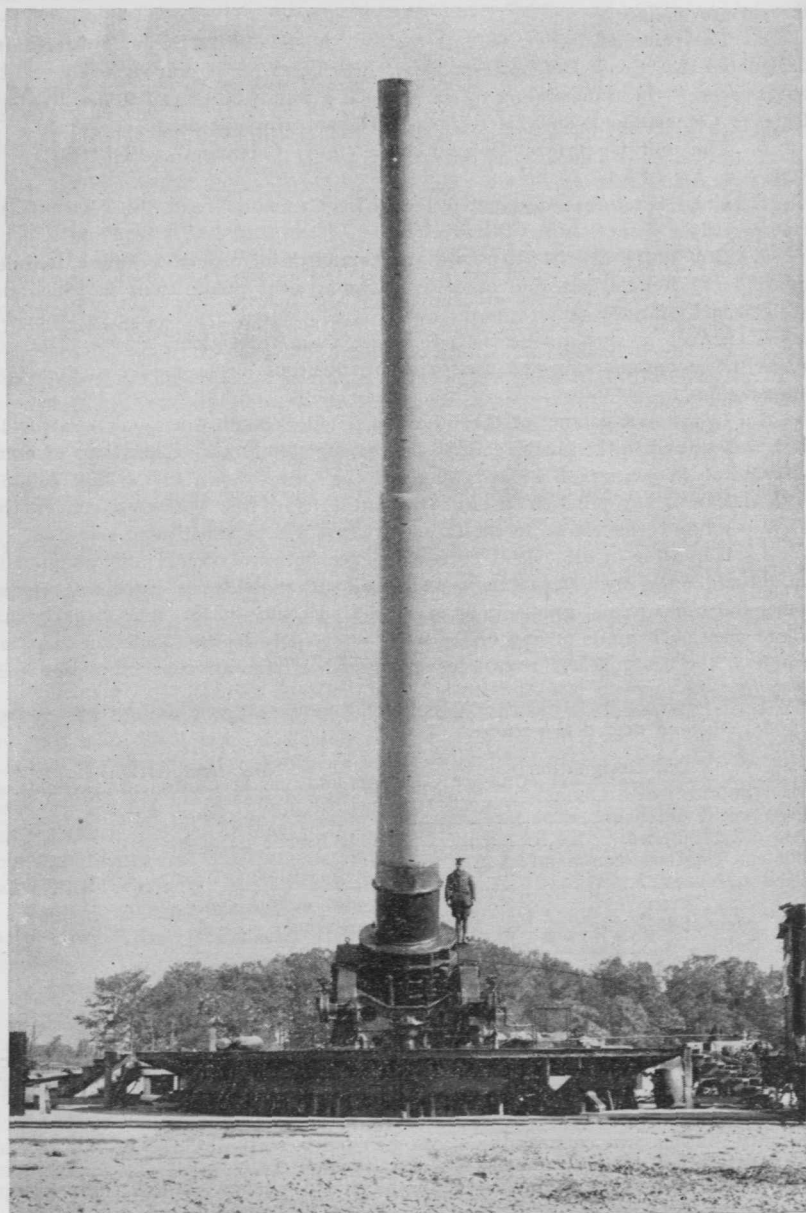
2. It is not practicable to revise and republish all orders, Training Regulations, Army Regulations, and other War Department publications in which the designations of these units appear; nor is it considered practicable to issue detailed changes in such publications to effect these corrections, as the instances where these designations are used are so numerous as to render such action uneconomical.

3. In the first column of the tabulation in paragraph 5 are enumerated old designations and in the second column the corresponding new designations of units referred to in paragraph 1; and wherever the terms shown in the first column now appear in any publication issued by authority of the War Department, the corresponding terms shown in the second column will be substituted therefor.

4. Hereafter in all official correspondence between officers and individuals in and under the War Department, and in all orders, bulletins, circulars, regulations, and other official publications issued by authority of the War Department, where mention is made of any of the units referred to in the tabulation in paragraph 5, the designations shown in the second column of that tabulation will be used.

5. *Old and new designations:*

Old Designation	New Designation
Coast defenses of.....	Harbor defenses of.
These coast defenses.....	} This harbor defense.
This coast defense.....	
This coast defense command.....	
Fixed defenses.....	Harbor defense (includes both fixed and mobile armament).
Fort command.....	Fort.
Fire Command.....	} Group.
Mine Command.....	
Fort commanders station or command post.	Harbor defense command post. Fort command post.
Battery commander's station or command post.	Group command post (first group, second group, etc.). Battery command post.
Primary station, fire command.....	} Primary station (first group, second group, etc.).
Primary station, mine command.....	
Double primary station, mine command.....	
Secondary station, fire command.....	} Secondary station (first group, second group, etc.).
Secondary station, mine command.....	
Double secondary station, mine command.	
Supplementary station, fire command.....	} Supplementary station (first group, second group, etc.).
Supplementary station, mine command.....	
Separate observing room.....	Observation post.



LATEST TYPE OF LONG RANGE GUN

16-INCH GUN, MODEL 1919 MIL. LENGTH 50 CAL.; MAX. ELEV.  $65^{\circ}$ ; MIN. ELEV.  $7^{\circ}$ ; M. V. 2700 F. S.; MAX. RANGE, 50,000 YDS. MOUNTED ON 16-INCH BARBETTE CARRIAGE, MODEL 1919. LOADING ANGLE,  $4^{\circ}$ ; TRAVERSE,  $360^{\circ}$ .

## A Tactical Inspection

EDITOR'S NOTE: *The Commanding General of the Third Coast Artillery District recently made a tactical inspection of the Coast Defenses of Chesapeake Bay. The instructions issued prior to the inspection are published below in order that they may be available for study or use in preparing for future inspections of a similar kind.*

### I. GENERAL ASSUMPTIONS.

#### a. The General Situation 9 (12 hr. 7 June 1925).

- (1) A state of war was recognized on 15 April 1925 between the UNITED STATES (Blue) and a strong combination of maritime powers (Black) is now operating in the Western Atlantic.
- (2) THE EASTERN FRONTIER COMMAND is in a position of readiness: this includes the 3d SECTOR, which in turn includes the NTH SUB-SECTOR: limited by the R. R. line RICHMOND—WEST POINT, VA. (all inclusive)—YORK RIVER (inclusive)—CHESAPEAKE BAY (exclusive except for sphere of action of armament)—HAMPTON ROADS and JAMES RIVER (both inclusive).
- (3) The following is the present disposition of ARTILLERY in the NTH SUBSECTOR:
  - (a) Under direct command of subsector commander:
    - (1) 52d C. A. (Ry) emplaced at FORT EUSTIS, VA.
    - (2) 51st C. A. (Tr) emplaced at GRAND VIEW, VA.
    - (3) 61st C. A. (A. A.) emplaced to cover FORT MONROE—GRAND VIEW Area.
    - (4) 53d C. A. (Ry) in reserve at RICHMOND, VA.
  - (b) Under direct command of Commanding Officer Coast Defenses of Chesapeake Bay.
    - (1) 12th C.A. (HD) manning fixed batteries at FORT MONROE, VA.
  - (c) The artillery at FORT STORY, VA., is assumed to be in the NTH SUBSECTOR.
- (4) There are important enemy objectives in the vicinity of YORKTOWN, VA., and NEWPORT NEWS, VA.
- (5) The missions of the above regiments are as follows:
  - (a) 52nd C. A. (Ry). To deny the enemy the use of the JAMES RIVER and YORK RIVER and to be prepared, with minimum delay to move to a new position.
  - (b) 51st C. A. (Tr.). To deny the use of the waters within their range to unarmored enemy vessels and to be prepared, with minimum delay, to move to a new position.
  - (c) 61st C. A. (A. A.). To deny the use of the air to enemy aircraft within range of the regiment's armament.
  - (d) Coast Defenses of Chesapeake Bay, 12th C. A. (HD). To deny the enemy the use of the waters within range of the armament manned.

b. The strength of the 61st C. A. (A. A.) and the 12th C. A. (HD) is assumed to be that authorized in Table of Allotment C. A. C. 12020, August 4, 1924, namely: 12th C. A.—25 officers and 443 enlisted men; and 61st C. A.—13 officers and 329 enlisted men.

c. The total allowance of ammunition available is sufficient to meet the demands of four hours fire action.

d. For tactical purposes the waters to the EAST and NORTHEAST of FORT MONROE are assumed to permit maneuver of BLACK battleships as close as the extreme range of major caliber batteries.

## 2. GENERAL REQUIREMENTS.

- a. Due to the absence of its personnel now with the 62d C. A. (A. A.) at Fort Totten, N. Y., the 61st C. A. (A. A.) will stand the inspection without materiel and will use only officer personnel and recorders, grouped about the regimental commander.
- b. The 12th C. A. (HD) will man the stations and communication system now assigned: the armament will not be manned. Recorders will be provided for all tactical orders, messages, and reports.
3. At 9:00 A. M. June 10, 1925, the District Commander, with his staff, will arrive at the Command Post to be selected by the Coast Defense Commander near which will be assembled the Commander of the 61st C. A. (A. A.) and his group of officers and recorders. From time to time special situations will be given to the two commanders; based upon these, estimates will be made, decisions reached, and orders given whenever the special situation demands it. This will be carried on down to include the batteries.
4. The tactical inspection will involve:
  - a. Attack on enemy aircraft.
  - b. Attack on enemy watercraft.
  - c. Employment of supporting artillery that will be made available.
5. Whenever it may be necessary in the tactical inspection to make assumptions, of whatever nature, within the problem to give full play to the tactical and technical possibilities of the exercises, this will be done: report being made to the next higher commander.
6. There will be given to the District Commander at the commencement of the inspection the following:
  - a. From the Coast Defense Commander, the Fort Commander and the Commander, 61st C. A. (A. A.), complete orders and detailed arrangements for the movement of the 61st C. A. (A. A.) from garrison status to their positions and for the movement of the 12th C. A. (HD) from garrison status to a position of readiness at their armament.
  - b. From the Commander, 61st C. A. (A. A.) a rough sketch showing the battery positions, stations and communications that would actually be used under the conditions.
7. At the end of the tactical inspection all officers of the two regiments will be assembled with complete records and a critique will then be held by the District Commander.
8. Immediately thereafter the complete record of all orders and communications sent and received during the special situations will be gathered together by the Coast Defense Commander and the Commanding Officer, 61st C. A. (A. A.) and handed to the District Commander.

NOTE: The above was furnished Commanding Officer several days prior to the Inspection.

## SPECIAL SITUATIONS

As each special situation is handed the Commander concerned, he will note the time, study the problem involved, and then give in order (when appropriate):

- a. The estimate of the situation.
- b. His decision.
- c. All necessary orders.

SPECIAL SITUATION No. 1.—(Time: 9 hr. 10 June 1925). The subsector commander has placed at the disposition of the Commanding Officer, Coast Defenses



of Chesapeake Bay, a battery of two 12-inch Railway Guns, Battignolle mount, with two hours ammunition (A. P. shot) with materiel for emplacement and necessary working and manning parties from 53d C. A. (Ry).

- a. Where would you emplace the battery?
- b. What base lines would you provide for the battery?
- c. What tactical disposition would you make of the battery?

SPECIAL SITUATION No. 2.—(Time: 9 hr. 20 min. 10 June 1925). Information received that BLACK has established airplane base in DELAWARE BAY and is contesting with BLUE for air superiority.

SPECIAL SITUATION No. 3.—(Time: 23 hr. 11 June 1925). A BLACK fleet including battleships, destroyers and transports, with temporary air superiority, has forced the entrance to CHESAPEAKE BAY during the afternoon and night of June 11th. What searchlight dispositions will be made for the night,

- (1) By Coast Defense and Fort Commanders,
- (2) By Commanding Officer, 61st Regiment (A. A.)?

SPECIAL SITUATION No. 4.—(Time: 2 hr. 12 June 1925). Destroyer division NORTHEAST of FORT MONROE moving NORTH in line ahead picked up by searchlight. Range about 8000 yards.

SPECIAL SITUATION No. 5.—(Time: 5 hr. 12 June 1925). Battery of 12-inch guns, Battignolle mount, ready for action. Weather hazy, visibility poor. At least two battleships seen from time to time NORTHEAST of FORT MONROE moving NORTH, within range of 12-inch mortars and 12-inch guns.

SPECIAL SITUATION No. 6.—(Time: 8 hr. 12 June 1925). Weather clearing. BLACK bombers with pursuit protection approaching FORT MONROE from the NORTHEAST.

SPECIAL SITUATION No. 7.—(Time: 8 hr. 30 min. 12 June 1925). BLACK bombers destroyed battery MONTGOMERY (6-inch). When informed of this, the subsector commander placed one battery of the 51st C. A. (Tr) at GRAND VIEW at disposal of COAST DEFENSE COMMANDER. What preparations would be made to use it to cover HAMPTON ROADS?

SPECIAL SITUATION No. 8.—(Time: 9 hr. 12 June 1925). BLACK now has air superiority. One division of BLACK battleships in line abreast closing in on FORT MONROE from NORTHEAST. Another division of BLACK battleships entering MAIN SHIP CHANNEL in line ahead. BLACK observation planes coming over FORT MONROE.

SPECIAL SITUATION No. 9.—(Time: 9 hr. 10 min. 12 June 1925). Periscopes of two submarines entering HAMPTON ROADS now visible.

SPECIAL SITUATION No. 10.—(Time: 9 hr. 30 min. 12 June 1925). Both BLACK DIVISIONS of battleships now within range of batteries.

NOTE: For obvious reasons information, which would be available, can not be given here to assist in solving portions of this problem.

## Antiaircraft Defense in Flanders

[Translated from the GERMAN PRESS]

*General.*—Unrestricted submarine warfare against trade commenced in 1917. In a few months it attained the importance of a decisive factor in the war. As was to be expected the enemy replied by strong offensives against the 4th Army, which protected the sea bases on the Flanders coast. The outcome was the battle of Flanders, which started with extensive operations in the air, increasing in

intensity all through the battle. After the collapse of the enemy's offensive on land the attacks by air increased still further, attaining their culmination point in the summer of 1918. Here, on the north wing of the western front, measures were taken to fight a decisive battle in the *air* for the domination of a portion of the *sea*, the progress and full meaning of which are of special interest as touching similar combinations in a future war. The headquarters command of the Naval Corps had made extensive preparations in good time. With the steadily growing success of the submarine war the Supreme Army Command also soon became convinced of the correctness of the demands made, and promised to render every possible assistance. Notwithstanding all elaborate preparations, the strength of the aerial forces employed by the enemy in time probably exceeded every conception and all expectations. Nevertheless the enemy left us a few month's time to elaborate our measures of defense. By so doing he enabled us to stave off, for the time being at any rate, an adverse decision against us.

*The Preparations.*—German preparations for aerial warfare comprised the reorganization and augmentation of the sea and land planes, and in combining the various sections of antiaircraft artillery under one command as the antiaircraft forces of the Naval Corps. Up to the beginning of 1917 antiaircraft operations by artillery was one of the duties of the Artillery regiments. Now four groups were formed:

1. The Coast group, with batteries from St. Paul to Mariakerke, which again was subdivided into two subsidiary groups, Zeebrugge and Ostend. Tactically the batteries of the army-antiaircraft gunnery school in and around about Blankenberghe were attached to them. Divisional Commander: First Lieutenant of Reserves of M. A. Hoffman, at Zeebrugge.

2. The Bruges group, which from a tactical point of view soon developed into the focal point. The Naval antiaircraft battery at Ghent was part of its organization. Divisional commander: Lieutenant J. N. R. of M. A. Hollweg at Bruges.

3. The West group with front towards Middelkerke-Lombardsyde-Dixmuiden, at times augmented by an army antiaircraft artillery group and always held by naval and army batteries. Divisional commander: Lieutenant J. N. R. of M. A. Reyman at Ghistel.

4. The Bavarian antiaircraft machine Gun Division No. 3. Owing to conditions at the front less capable of independent action than others, yet this division performed excellent services in cooperation with antiaircraft guns and aviators, in the intelligence service and in the training of machine gun crews.

At times it was successfully employed in combination with other sections as an infantry machine gun force on the land front. Divisional commander: Captain Bosmiller at Stalhille.

We get an idea of the rate of development of this service when we look at the available artillery park in active service at the front (15, 12.5, 10.5, 8.8, 7.7, 3.7, cm guns): in 1917 about 70; in 1918 about 212. To these must be added kites and balloons at about 120 flying stations, mainly round about Bruges and subordinated to that group. Kites and balloons were not nearly so much in evidence at the locks at Zeebrugge, and were little used, at the request of the seaplane pilots.

The extension of the intelligence service proceeded hand in hand with the augmentation of fighting material, the reliable and quick working of the former being a matter of supreme importance in aerial warfare. Each battery was furnished with 2-3 observation stations, fitted with the best optical and acoustic in-

struments. They were dispersed all over the country, wherever possible combined with searchlight stations, towards the enemy and on the frontiers numerically as strong as possible, and fitted with their own widely extended net of telephone connections. Their reports were collected in three central aviation intelligence stations, sifted and arranged, and passed on to threatened points, last of all to headquarters at Bruges. By this means danger was best averted and cooperation of all concerned assured. The searchlights were combined into groups of 3-4 and were not tied to any one particular position. The leading searchlight of each group was entrusted with the duty of announcing the direction in which the enemy was advancing, and the duty of the others was the illumination of the targets. The batteries were furnished with the very best measuring instruments, and partly with shooting appliances for antiaircraft guns. Batteries in fixed positions were mostly commodious and well concreted outfits with fixed positions for the guns. Movable, i. e. interchangeable positions were only provided for in the West group, where occasional very heavy enemy artillery fire made such an arrangement necessary. The guns from 7.7-cm. downwards naturally made the very best possible use of their mobility, likewise the 8.8-cm. railway-truck guns. As regards the remainder, the good but heavy artillery, and also the nature of the objects to be protected made fixed positions for the guns an absolute necessity.

Permanent theoretical and practical courses of instruction looked after the training of the personnel. They were also regularly attended by men of the fleet and from home, and also at times from our allies. Lively intercourse with the army antiaircraft gunnery school led to exchange of experience. But the best teacher of all was the enemy with his never ceasing activities. When in the summer of 1917 he began to become a heavy burden, the strength of the force had been built up to about 50 per cent of the ultimate strength in view.

Up to then the focal point of the fighting on land at Ypres had acted like a magnet on the bulk of the enemy's aerial forces. The French aviators, who were not much feared, soon disappeared from the coast entirely, and were replaced by the far more resolute and indomitable English. Imbued with extraordinary personal bravery, the English air forces also endeavored to adapt themselves materially to the new measures of defense adopted by us. The excellent de Havilland and Handley Page planes soon doubled the altitude to which they were able to rise, to avoid or diminish the danger zones. That fact apparently put an end to kite and balloon barrages. In actual fact it protected the objects surrounded by them against attacks by low-flying planes, which are by far the most difficult to fight against. The increased altitudes of enemy planes, however, benefitted us also, as they reduced the difficulty of aiming at quickly moving targets, and as a result the work of the antiaircraft guns as regards time and stability, observation and steadiness of aim, improved. On the other hand the artillery lost in breadth of range what it gained in height, and that meant increasing the number of guns. It had to be done, however, and the admiralty in the end voted, before it was too late, that which the Supreme Army Command could not grant, although many a time a hard battle with pen and ink had to be fought to get it. Before long the enemy presented us with new bombs of great explosive power and considerable weight.

Thus on both sides the year 1917 was chiefly notable for increase of materiel for aerial warfare. On the other hand one could not as yet discern anything in the nature of aviation tactics, properly so called, on the enemy's part. The enemy made good use of flying weather, tried to get at the target, but as a rule promptly

cleared off without reaching it when he got within range of our artillery fire. He evidently still lacked ingenuity to side-track our measures of defense. In the tactical race we were just about a head's length ahead of him. This proportion naturally was fraught with the danger of our settling down into a groove. But we were not kept waiting very long; an impulse, suggesting the advisability of keeping awake and progressing, came very soon.

*Tactical Developments.*—In keeping with the tactics of the enemy, measures of defense were very simple at first; in the daytime and by searchlight firing at visible targets, and when all was dark blockading fire at various altitudes over the object to be protected. In all these the great speed of the moving targets called for intensive fire in sudden bursts.

In the scientific and practical development of antiaircraft gunnery distinguished services were rendered by the Chief Adjutant, First Lieutenant of reserves of M. A. von Sanden, who was at one time professor of mathematics at the University of Gottingen. Of convincing lucidity in speech and in his writings, and himself deeply imbued with the correctness of his methods, he earnestly but yet also with a spirit of humor faced all the manifold difficulties that had to be dealt with, assiduously teaching and instructing, and well versed in all the phases assumed by criticism. The point was, to adequately express in the simplest form of a military command the four elements which were constantly influencing each other, namely: altitude, distance, vertical and lateral deviation. The latter was not really satisfactorily achieved until the year 1918. The high rate of speed of 40-70 m/sec. at which the targets were moving, and the free tridimensional mobility of the same preclude all possibility of rectifying fire. The natural dispersion of barrels and fuses permits and favors the abandonment of graduated ranges. Hence the method adopted: a volley fired at command by batteries of as many guns as possible; two or three volleys in quick succession; waiting for result of lateral observation; and with corrections accordingly a new sequence of volleys. Assuming, of course, a high velocity of the projectiles and absolutely reliable fuses. In practice it was at times found to be a good plan to have the fire under dual control, one officer giving altitude and range, another altitude and lateral correction. This method permitted of many variations, and was used together with single control; the nature of the work in hand called for quick adaptation to conditions as they presented themselves; hard and fast inflexible rules were out of place.

Basing its methods upon the experience gathered by the force as a whole under all sorts of conditions, the leaders of the antiaircraft forces gradually confined themselves to restricting the latitude allowed to the batteries, and so were able to build up useful practical rules.

Blockading fire was developed on similar lines. The aviator, invisible in the darkness, was only discernible to the ear. Consequently the opening of blockading fire always depended upon the individual faculties of the observer at the object of attack. The bulking together of bursting shells, fire distribution and fire discipline were matters under control of the group or divisional commander. The success of antiaircraft measures was at all times, but especially at night time, in a very great measure dependent upon harmonious cooperation between batteries, intelligence and searchlight service, both in the sector and throughout the force all along the line. The more promptly and accurately the local command was notified of the approach of the enemy, the greater the chances of success of the measures of defense. At the same time it was necessary to refrain from excess of zeal in transmitting reports, and not to be too lavish in sounding the

alarm. Bruges and the Coast in 1918 had to repulse a bombing attack about once every two hours, if flying weather was favorable, and unfortunately that was the case almost all the time. On the other hand our own aviators were out and at work at the same time, so that the demands upon the antiaircraft service were extraordinarily heavy. The outcome was that quite a number of specialists grew up, specialists in seeing, hearing and distinguishing, specialists in location and in grasping the situation, all of which could only be achieved by absolute devotion to the work, and training of men and officers. Before long the Bruges section became the standard by which the others were measured. Although the other groups contributed a considerable share, yet the highest praise is due to the divisional commander at Bruges, Lieutenant J. N. R. of M. A. Hollweg. Sure and quick in decisions and always on the spot, he had the knack of imparting his own knowledge and views to every one of his subordinates, and to raise up and maintain a high standard of ambition and sense of duties in an admirable manner.

A much more thankless and difficult task was the work on the coast. To set out advanced outposts on the water was useless. The motion of the sea, wind and ships' engines interfere with the sight and hearing. Observation close in shore was subject to practically the same disturbances. The coast line therefore was always more exposed to surprises than the other positions, a hint not to build valuable factories, etc., near the coast. What the coast lacked in warning reports it had to make up for in superior vigilance and preparedness. It fully came up to expectations and all demands made upon it. That is evidenced, among others, by several important happenings in the spring of 1918. A few days before the British attempt to blockade Ostend and Zeebrugge, the aviation intelligence of the group reported that the suspicious movements of English aviators in the early dawn appeared to point to some very special operations about to be carried out. The attack that followed was recognized by the Coast group first of all, which gave the alarm to the shore batteries, and on the mole at Zeebrugge successfully attacked the English landing troops with machine guns and hand grenades. When shortly afterwards H. M. the Emperor inspected the field of action, an enemy bombing plane, unobserved, joined our own scouts. Recognized by the antiaircraft guns at Zeebrugge in the nick of time and fired upon with effect, the enemy plane dropped its bombs a few hundred meters away from its target.

A few weeks previously Zeebrugge had the good fortune to bring down the English squadron leader, Lt. Col. X. This brave and energetic leader was doubtless the life and soul of the English air force, and the originator of the enemy's bombing tactics which were such a source of trouble for us. It was he who organized and trained the daylight massed attacks with 30-70 bombing and fighting planes. These swarms, subdivided into groups of 3-4 planes each and flying in formation at different altitudes maneuvered with extraordinary skill, and made the best possible use of every aid to surprise attacks. Such as twilight, light, ground fog, low lying tumbled clouds, advance over the sea, etc. After the bombs had been dropped the fighting planes descended to low altitudes and attacked living targets and inflammable buildings with machine gun fire and incendiary bombs. Each new form of attack was first tested by the leader himself. Thus, for instance, he had made up his mind to destroy the locks at Zeebrugge. At early dawn 5000 m. up above the point of the mole, he descended, gliding at top speed, to 50 m. over the canal and the locks, in the belief that with such a surprise every attempt at alarm must fail. He paid for his first attempt by being

shot down, was wounded, taken prisoner and sent to one of the hospitals at Bruges. Intercourse with this intrepid and chivalrous opponent soon assumed almost friendly forms, and with his retirement from active operations tactical development on the enemy's side came to a standstill.

The batteries of the West group were frequently exposed to heavy fire, a sign how unpleasant their activities were to the enemy. Thus, for example, in the summer of 1917 five (it is true, very far advanced) batteries in fixed embrasures were shot entirely to pieces within ten days, and covered with about 2000 shells of heavy and heaviest caliber every day. They were reestablished more to the rear under great difficulties. Quick-firing guns and machine guns remained behind close to the enemy's lines to keep off planes attacking the trenches, and also the advanced observation stations to keep them company. About 23 km. to the rear followed the horse-drawn army batteries and to the rear of them the naval batteries in fixed positions. With plenty of fighting going on all the time the observation and intelligence service proved a very valuable adjunct in forming opinions on the general tactical position. A specialty thought out and worked by a Belgian aviator was very disagreeable for a long time, namely firing from captive balloons. These balloons sailing fairly low down, and making full use of illumination, hollows in terrain, farm buildings, groups of trees as camouflage, he made 8-10 successful attacks. Finally after exhaustive experiments and preparations, in which the Bavarian machine gun section also took part with good effect, he was successfully driven off by means of "fire screen" and ultimately shot down in descending. The courageous leader escaped wounded, and, by the way, a short time afterwards wrote us a post card, expressing his appreciation. As far back as the winter of 1917-18 the commander had felt it his duty to train and prepare the officers by giving them practical problems to solve. Theoretical results and practical experiences over and over again culminated in a demand for a combined fighting organization with the fighting aeroplanes. Close cooperation according to a prearranged plan promised to be a successful proposition. The new chief of the air forces and the squadron leaders fortunately appreciated the arguments advanced in favor of such a combination and promised open-hearted support.

The guiding principles which were worked out by both branches had for their object the entangling of the enemy in combat in the air according to pre-determined plans, and to provoke or force an aerial battle on a large scale. The most satisfactory and successful outcome was the constant intimate cooperation, the playing into each other's hands, perfect in operation in every detail, of intelligence, aviation, and antiaircraft gun-service. Active participation of commanders and officers on both sides in everything connected with the solving of the problems in hand, in experiments and reconnaissance flights, tended towards the maintenance of mutual understanding, interest and, not to be despised by any means, a feeling of comradeship. Prevailing conditions, more or less permanent, in the Naval Corps favored cooperation of this kind. Under other conditions and in mobile warfare (as opposed to position warfare) such results can only be achieved if all antiaircraft forces of a General Command are united under *one* chief command.

The tactics of the enemy's night-flying planes centered first of all upon attempts to reduce the effect of our blockading fire. 4-6 planes carefully circled round an object singled out for attack, drew the blocking fire by feigned rushes, and attacked immediately *after* the fire wave, during the listening interval, or dropped their bombs *during* the fire on some other unprotected object in the

vicinity. As the dexterity of the searchlight crews increased these tricks of deception no longer worked, and the enemy thereupon favored the much more unpleasant tactics of exhaustion. Isolated big bombing planes, sailing along one after the other in marching order, kept the alarm going for hours on end, gradually collected at the attacking point and then suddenly advanced to the attack in mass formation. This led to combined night antiaircraft measures by aviators and antiaircraft guns. At intervals of about 10 km. from the main object of attack (Bruges) the foreground was divided into sectors, distinguished by electrically illuminated direction and sign posts and searchlights. In each sector, when called upon, 1-2 "C" planes patrolled the ground at a low altitude when the enemy's approach was reported. Without having searchlights trained upon it but located by its position to the illuminated sign posts, the enemy plane was in danger of being outlined against the sky and recognized by the defending plane flying beneath him. With searchlights the chances of being able to attack the enemy plane increased considerably. The first experiments after lengthy exhaustive preparations, in which the commanders took part personally, already led to a complete success: two big bombing planes of 30 m. wing spread were shot down.

Although this may have only been a lucky chance, yet the enemy felt the blow severely, and for some time gave up night attacks, and fitted himself up with dazzling lights which were to act as a light screen between himself and the antiaircraft defenses. The means were as yet imperfect, but nevertheless were well worth noting and thinking about.

When matters had reached this interesting stage further progress was stopped by the sudden order to retire. A good deal of the valuable material was fitted up in and around about Antwerp, and on November 9th it was handed over to the enemy. We had looked forward with perfect confidence as to what the outcome of the war would be.

In the year 1917 and 1918 it is proved that more than 400 enemy aviators were shot down in North Flanders, 133 of these were credited to the antiaircraft artillery, and the rest to the fighting airplanes. Approximately 100 were brought down by the guns in 1918.

In conclusion the question remains to be answered, to what extent the enemy's aerial attacks were successful, and to what extent they influenced the operations in Flanders and at sea. The enemy's aerial attacks undoubtedly called for a considerable increase in the quantity of antiaircraft material which Germany had to provide, but they were not able to seriously affect our conduct of operations at sea. The shipyards, depots, locks and other plants in connection with naval warfare were on no occasion seriously damaged, nor was it ever necessary to suspend work in them. The loss of men on the German side was considerable; the victims among the enemy population of the occupied territory, especially in Bruges, probably amounted to a few hundred. The last mentioned fatalities practically ceased altogether as soon as a sufficient number of dugouts, cellars, etc., had been provided as shelters for the population against bombs, and once the people had learnt to take cover in them in good time. All that was achieved, therefore, in the way of material results by the big scale enemy bombing attacks was the destruction of a goodly number of old houses near the yards at Bruges.

#### SPECIMEN RECORD OF ANTI-AIRCRAFT OPERATIONS AT NIGHT NEAR BRUGES

Aug. 18th. Weather clear. Wind power 2. Moon rises 11:30 p. m.

## A. BRUGES CENTRAL STATION

- 7:00 pm. Report from Ghent: German fighting units night flights. Pass on to Groups and batteries.—Order for Groups; Report to aerodromes: 10 pm. wire protection standing as high as possible.
- 9:00 pm. Report from Ghent: Start between 9 and 10 o'clock. Aviation fires on coast burning from 9:20 until further orders.—Pass on to groups and aerodromes.—To aerodrome Stalhille: Night antiaircraft planes ready to start from 10:00.
- 9:30 pm. Report: Wire screen standing, altitudes over 1700 m. cannot be reached owing wind high up. Balloons, as no ground wind.—Pass on to groups and aerodromes.

## B. FIRING LINE BRUGES GROUP

- 10:20 pm. Report from aerodrome Stalhille: Four "C" planes ready to start for antiaircraft operations.
- 10:30 pm. Report from West, Central Station: Enemy aviators audible direction Dixmuiden about 3000 m. up.—Pass on to aerodrome Stalhille.
- 10:31 pm. Report from Ghent: Fighting squadron started direction coast.—Pass on to groups and batteries.
- 10:33 pm. Report from Thourout: Enemy aviators audible over Dixmuiden about 3000 m. up.
- 10:34 pm. Report from Stalhille: Two "C" planes started direction Dixmuiden. Two "C" planes starting at once direction Nieupoort.
- 10:36 pm. Report from West, Central Station: Enemy aviators south of Ghistel 3000 m. up.
- 10:37 pm. Report from Thourout: Enemy aviators over Thourout, 3000 m. up, direction Bruges.
- 10:38 pm. Order: Searchlight Group I permission sweep Thourout.
- 10:40 pm. Observation: Searchlight Group I lighting up.—Order: Alarm! Blockading fire I position "high," direction Yard, Railway antiaircraft guns and Lophem Artillery Depot.—Report from Ostcamp: Own aviators audible direction Ghent towards coast.
- 10:43 pm. Observation: An enemy big bombing plane in searchlight, battery Lophem and railway antiaircraft guns get on the target.
- 10:44 pm. Report Coast: Enemy aviators audible seawards Bredeene.
- 10:46 pm. Order: Searchlight Group II get on target. Observation: Antiaircraft guns Andreas fire at target.
- 10:48 pm. Searchlight Group II lighting up. Searchlights Zeebrugge lighting; fire at target at Zeebrugge.—Order: Searchlight Group I dim lights.—To observation at Yard: permission for blockade fire.
- 10:50 pm. Observation: Blockade fire Yard.—Blockade fire Zeebrugge.
- 10:53 pm. Report from St. Paul: Enemy aviators from Holland 2500 to 3000 m. up, direction Bruges.—Order: Searchlight Group III and IV permission sweep direction St. Paul.—Report from Stalhille: Own aviators over Stalhille, direction Ostend.—Observation: Bombs dropped direction Yard.—Order: Blockade fire stop!
- 10:55 pm. Observation: Searchlight Group IV lighting up.—Report from Damme: Enemy aviators audible direction.
- 10:55 pm. Damme—St. Croix. 2800 m. up. Observation: St. Croix fire at target. Order to observation at Yard: Permission blockade fire. Observation: Blockade fire at Yard.
- 10:56 pm. Observation: Bombs dropped direction Yard.



- 10:56 pm. Order: Blockade fire, stop!
- 10:57 pm. Order: Inner searchlights screen.—Observation: Bombs dropped direction Artillery Depot.—Order: Searchlight Group I light up Artillery Depot!
- 10:58 pm. Observation: Searchlight Group I lighting up; has got on target; anti-aircraft guns Lophem fire at target. Railway anti-aircraft guns likewise. Target covered.
- 11:02 pm. Batteries cease firing.
- 11:03 pm. Report Stalhille: "C" plane attacking.—Pass on to batteries and Searchlight Group I.
- 11:05 pm. Order: Alarm back, preparedness for alarm!—
- 11:09 pm. Report: A heavy bomb, yard entrance south; electric cables damaged, no losses.—12 bombs outside yard, to the west, 8-10 bombs outside yard, east of canal.—One bomb in town south of yard, one house destroyed, several Belgians wounded and killed.—Two bombs railway east of Artillery Depot, no damage. Weight of bomb about 200 kg.
- 11:16 pm. Report of batteries on ammunition used.—St. Croix: Two aviators in searchlight, well covered, one of them very shaky, after third volley veered off seawards.—Lophem: One enemy aviator well covered. St. Angree: One plane well covered, pressed hard, after 2d volley veered off seawards.—Stalhille: Approached up to 150 m., when searchlight lost the target, fired about 20 rounds machine gun. Enemy damaged, apparently turned off southwards.
- 11:18 pm. Report from Coast: Enemy aviator, apparently damaged abt. 1800 m. flying away seawards.—Stalhille: All "C" planes landed, four ready to start.

### Artillery Ordnance Development

EDITOR'S NOTE: *The following notes were compiled in the Office of the Chief of Coast Artillery by Captain Aaron Bradshaw, C. A. C. Credit is accorded the Monthly Digest of Activities of the Ordnance Department, for much of the information contained therein.*

TEST OF ANTI-AIRCRAFT MATERIEL.—I recently witnessed certain tests at Aberdeen Proving Ground. The first one was a test of a 3-inch anti-aircraft gun Model 1918 on auto-trailer mount. This mount had been provided with four 6-foot side outriggers in place of the old outriggers, and with four additional front outriggers. Provisions were also made for screwing the lifting jacks down and to leave them in position during firing. The steps taken as outlined above improved the stability of the mount but did not stop the movement of the top carriage during firings. As a result of this partial failure further steps were taken to improve the stability of this mount. This led to the development of an improvised concrete block to which the mount will be anchored in position during firings. One of these blocks was constructed at Fort Tilden, and the preliminary firings indicated that it satisfactorily solves the problems which have caused so much trouble. Quick setting cement was used in the construction of this block and it set and was ready to be fired from within 24 hours. The use of these concrete blocks does not interfere with the mobility of the mount.

A test was also held to determine whether stereoscopic range finders are valuable in directing machine gun fire by means of tracers. It was decided that these instruments have some real value for this purpose, and steps are being taken to arrange for more extensive service tests.

The 3-inch Auto-Fretted carbon steel gun being tested at Aberdeen Proving Grounds to determine its accuracy life has been fired 1900 rounds. It had an

accuracy of 200 yards at 9500 yards on the nineteenth hundredth round. It is expected that the accuracy life of this gun will reach 2500 rounds. The firings held started with a M. V. of 2600 f. s. and this has been reduced down to 2400 f. s. The results obtained from this gun should be contrasted with the older type guns where considerable trouble was experienced in trying to get the accuracy life up to 250 rounds.

I also inspected an Auto-Fretted removable liner tube for a 3-inch gun. This tube is so constructed that it could be easily removed in the field with the simple tools to be supplied for that purpose. The Ordnance Department believes that these removable liner tubes might be a real solution to the wear problem.

**105-MM. ANTI-AIRCRAFT GUN.**—The characteristics for the 105-mm. anti-aircraft gun, Model 1927, were approved April 23, 1925, and the work on this new gun is being pushed ahead.

**SUBCALIBER MOUNTING.**—The manufacture and test of the subcaliber mounting for the 16-inch Barbette Carriage, Model 1919, was approved on April 16, 1925. The sub-caliber gun is a .75-mm. gun, Model 1906. This gun with its recoil mechanism, will be mounted above the 16-inch gun in a bracket which will be clamped to the outside of the 16-inch gun just in front of the cradle.

**CLOKE PLOTTING BOARD.**—The manufacture of a special Cloke plotting board for long range batteries was approved April 30, 1925. This board will be more satisfactory for use with long range guns since the plotting board, plotting and relocating arms are longer than those on the modified Whistler-Hearn boards. This means that the scales on the arms are larger. It is contemplated that this board will be issued to the Coast Artillery Board for test as soon as completed, and after the completion of the necessary test by the Coast Artillery Board, it will be sent to the Hawaiian Department for service test.

**ANTI-AIRCRAFT MACHINE GUNS.**—Intensive development programs have been under way with a view of improving the fire of anti-aircraft machine guns. The first program being conducted has for its object the development of a real effective sight for .30 caliber and .50 caliber machine guns. Sights for the .30 caliber machine guns have already been delivered and are being used extensively at Fort Tilden and have given indications that they might be real effective sights. Sights of a similar type for the .50 caliber machine gun are expected to be delivered prior to August 1st.

The second development program has for its object the supply of shoulder rests for the .30 and .50 caliber machine guns. Orders have been presented for the manufacture of 26 shoulder rests for the .30 caliber Browning machine gun and 24 shoulder rests for the .50 caliber machine gun. It is expected that these shoulder rests will be delivered to the various anti-aircraft regiments at an early date.

The third development program has for its object the supply of tripods for the .30 and .50 caliber anti-aircraft machine guns. The type of tripod which has given the greatest promise is designed to mount either the .30 or .50 caliber machine gun. Ten of these mounts have been delivered and are being subjected to a preliminary test at Aberdeen Proving Grounds. Upon completion of this preliminary test, these mounts are to be issued to the 62nd Coast Artillery. Similar mounts are expected to be issued to the other anti-aircraft regiments at an early date.

**37-MM. ANTIAIRCRAFT GUN.**—The development of the 37-mm. 3000 f. s. anti-aircraft gun has been progressing nicely and 275 rounds of ammunition has been sent to the Aberdeen Proving Grounds for use in the firings of this mount.

**SHELLS AGAINST AIRCRAFT.**—An extensive program has just been fired to determine the rates of effectiveness of the 3-inch anti-aircraft high explosive shell against airplanes. The complete report of these firings has not been received, but it is understood that these firings will show that the danger area which we have been using in computing anti-aircraft hits is approximately correct.

In order to determine whether it is possible to obtain a more efficient type of projectile for use against aircraft, studies are being made of various unconventional types, which are in general, modifications of the older type segmental shells. The general purpose of these studies is to determine whether it is possible to reduce by any extent the quantity of matter which is pulverized into small noneffective fragments in conventional designs.

The Mark II anti-aircraft fuse is to be replaced at an early date with the Mark III type. This action has resulted from recent firings with the Mark III fuse. These firings indicated that the standard Mark III fuse is more uniform in its action than either of the other two types.

## Some Quartermaster Achievements

*By* CAPTAIN J. V. ROWAN, Q. M. C.

On June 16, 1775, the Quartermaster Corps came into existence as the Quartermaster Department by the following resolution of the Continental Congress: "That there be one Quartermaster General for the Grand Army and one deputy under him for the separate Army." Recent investigation made in the Quartermaster General's Office and at the Philadelphia Quartermaster Corps School indicates that Congress was at that time in session at Independence Hall (State House), Philadelphia.

The ration of the Revolutionary era was pitifully inadequate. What heroic fortitude it required to exist on the following food supply may be imagined much better than it can be described. Think of this for a daily allowance: 1 lb. of fresh or salt beef;  $\frac{3}{4}$  lb. of pork or bacon; 1 lb. of flour;  $\frac{1}{2}$  gill of spirits; and to each 100 rations 1 qt. salt; 2 qts. vinegar; 2 qts. soap; 1 lb. candles.

With the exception possibly of the item of spirits, this was truly an iron ration. No bread unless you baked your own; no coffee at all; no sugar, no butter, no vegetables; in fact, none of the excellent variety and unquestioned palatability that characterizes the modern mess. What a dreary monotonous diet upon which to fight seven long, weary years!

Over two and one-tenth billions of dollars were expended by our service on textiles, leather, rubber goods and miscellaneous items of a similar nature. Wool alone cost over one-half billion dollars and we utilized four-fifths of a billion square yards of cotton textiles. The necessity of completely outfitting each soldier caused clothing purchases to actually exceed the annual pre-war production of the country on many items. For instance, in 1918, socks purchased exceeded pre-war production by fifty per cent. The heaviest types of shoes lasted less than a month during intensive fighting periods. Clothing items alone, purchased and delivered by the Quartermaster Corps, to the fighting troops, cost around one billion dollars.

It would be idle to dwell on miscellaneous supplies, this in view of the fact that they involved over 120,000 separate items.

### Coast Defense Day at Fort Adams

During the year 1924 and 1925 much thought was given to the subject of bringing together the commissioned officers of the various elements of the Army—Regulars, National Guard and Organized Reserves—with whom the officers of these defenses would in the ordinary course of their duties come into contact. The experiment of a general get together was tried out in 1924. This was of a social nature, although the military end was stressed to some extent. This year, 1925, a rather different program was prepared with the object in view of bringing before the officers and the civilian guests the importance of this particular coast defense in the general scheme of coast defense and more particularly the important position which they, the officers and guests, occupied in the defense of Narragansett Bay.

A problem was prepared based on the defense plans and its solution was worked out. Everybody present participated in the solution and actually saw before him the methods employed. This aroused curiosity and stimulated interest and was the subject of much appreciative comment.



COAST DEFENSE DAY AT FORT ADAMS, R. I.

The following memorandum shows the events in which all participated:

1. Thursday, May 21, 1925, Coast Defense Day, is the day set aside for assembling officers and men assigned to the Coast Defenses of Narragansett Bay and invited guests,—partly for professional, partly for social purposes. The many expressions of interest in last year's Coast Defense Day leads to the hope that it will become an established custom to have such an assembly annually.

2. Tentative program:

- (1) Buffet lunch at 12:00 noon at the Service Club for all officers and dinner for visiting enlisted men with the Headquarters Battery, 10th Coast Artillery, at 12:00 noon.

- (2) Target practice with 12" mortar battery at Fort Adams, by the Headquarters Battery, 10th Coast Artillery, at 2:00 p. m.

- (3) Combined parade of 10th Coast Artillery and 243d Coast Artillery at 4:00 p. m.

- (4) Tea at Commanding Officer's quarters, for officers, at 5:00 p. m.

- (5) Supper for visiting enlisted men with Headquarters Battery, 10th Coast Artillery, at 5:30 p. m.

(6) Supper for visiting officers, staying over for the dance, at Commanding Officer's quarters, at 7:00 p. m.

(7) Dance at Service Club for officers at 9:00 p. m.

### 3. Boat schedule:

(1) The "Condon" will leave Providence at 9:00 a. m., for Fort Adams. Returning, it will leave Fort Adams at 6:00 p. m.

(2) The "L-43" will leave Saundertown at 10:00 a. m., for Fort Adams. Returning, it will leave Fort Adams at 6:00 p. m.

NOTE: 1—Major Collins, 243d Coast Artillery, will arrange for the landing place in Providence and inform the personnel of his regiment. Others will be informed by Major Atwood.

NOTE: 2—The "Condon" will carry 200 passengers; the "L-43" will carry 60 passengers.

The attendance was very encouraging; the 243d Coast Artillery (H. D.) (National Guard) made a splendid showing, there being twenty (20) officers and one hundred and seventeen (117) enlisted men present. This is about twenty-five per cent of the strength of the regiment. They travelled from Providence a distance of forty-five miles. There were thirty-five Reserve Officers present, all from Providence, New Bedford and Fall River.

Brigadier General James Parker, (retired) and Brigadier General John D. Barrette, Commanding General, First Coast Artillery District and Lieut. Colonel F. W. Stopford, C. A. C., Adjutant, First Coast Artillery District, Colonel Edward P. O'Hern, Ordnance Department, Ordnance Officer, First Corps Area and Major R. G. Herman, G. S. C., G-3, First Corps Area, were the Corps Area representatives present and Lieut. Colonel Thomas Hammond, Major H. V. Allen and eighteen other officers of the 243d Coast Artillery (H. D.). Representatives from the 544th A. A. and 489th Coast Artillery, Organized Reserves, were also present besides a number of reserve officers from other organizations.

The United States Navy was well represented by Captain Orton P. Jackson of the Naval Training Station and Captain Ralph C. Earle of the Torpedo Depot both accompanied by their entire staffs.

The municipal authorities of Newport sent representatives which included the Mayor, Hon. Mortimer A. Sullivan.

The Chamber of Commerce was represented by its President and Secretary and four members.

One of the gratifying results of the publicity was the attendance of prominent civilians among whom were Commander Marion Epply, U. S. N. R. F., Mr. Walter Andrews, Mr. George Cozzens, Mr. Andrew F. Robison and Mr. Joseph Harriman.

Considerable publicity was given the affair through personal letters and the press. Representatives from the Providence and Newport papers were present and reports of "Defense Day" were contained in all the local and Providence papers the next day.

From comments, queries and reports we have succeeded in bringing the officers into closer touch. We have aroused their interest in Narragansett Bay—their home defense. We have shown them their problems and how they are the ones to solve that problem.

"Coast Defense Day" hereafter to be known as "Harbor Defense Day" will be a permanent fixture at these Harbor Defenses of Narragansett Bay.

## Effectiveness of Antiaircraft Fire

*EDITOR'S NOTE: The following is extracted from a lecture prepared under the supervision of the Antiaircraft Defense Bureau of Italy. In considering the statements of the number of planes brought down by ground fire, it should be remembered that although the speed and flying height of planes have greatly increased since the War, the present-day types of antiaircraft cannon, machine gun and fire control equipment are vastly superior to earlier types.*

It is the conviction of many that the only means of defense against the attacks and threats of the enemy aviation service is that of having a very powerful aviation service, which, with its combined action of pursuit and bombardment, must acquire absolute mastery over the enemy, preventing him from flying over our territory and our lines.

Now, even if we are convinced that the first indispensable element in the fight against aircraft is the possession of a strong aviation service, it is not believed that this could be sufficient in itself to afford at all times and places an adequate protection against air attacks.

An aviation service, no matter how superior numerically, technically and morally, to that of the enemy, will never be able from the first day of the struggle, to prevent that of the enemy from accomplishing or attempting bombardments, from accomplishing or attempting reconnaissance, or, in short, from trying to accomplish its own missions. If it can prevent it in one sector, it cannot do so in another; if it succeeds in bombarding one field, other fields and other aircraft will remain intact.

No matter how strong, no matter how daring, no matter how aggressive, an aviation service may be, it can never prevent, throughout its whole territory, that of the enemy from executing its multifarious actions, even though on a reduced scale.

Now, precisely on account of the difficulties inherent in antiaircraft fire, a special gun is indispensable which has special characteristics, is served by very experienced personnel who know perfectly the technique and the method of employing that kind of fire, and are constantly familiarized with the arm which represents the objective against which their action is to be directed.

And yet, notwithstanding the deficiency of antiaircraft artillery during the war, the number of aircraft brought down by it reached 129 out of a total of 540 aircraft brought down by our aviation service on our front.

The statistics of the allied armies all based on official documents yield an equal percentage (Germany, 1520 aircraft brought down by the artillery out of a total of 6554 aircraft brought down by the aviation service; France, 500 aircraft brought down by the artillery out of a total of about 2000 brought down by the aviation service).

In France, still another high percentage has been reached; and it will perhaps serve still better to give an idea of the efficiency of antiaircraft artillery; the relation between the number of shots actually fired, and the number of aircraft brought down, about 11,000 shots were required in 1916 (and) that their number was reduced to about 7500 in 1918. And this progress must be appraised in relation also to the progress which aviation made in the same period, gaining in altitude, velocity, and ease of manipulation.

These statistics have been compiled so as to include all guns which executed antiaircraft fire. If then we limit them to special antiaircraft guns alone, the proportion descends rapidly in 1918 to one airplane brought down for every 3200 shots fired, and this number can be judged at its true value, if it is borne in mind that it is much less than that proved necessary for field artillery to destroy one enemy gun.

And then we must bear in mind also to appraise the work of antiaircraft arms, that it is not only by the number of aircraft brought down that their efficiency can be determined.

The fact of obliging an airplane to fly very high, to change its route, to increase the distance traversed, to carry on a bombardment from a high altitude in the continual danger of being reached by the antiaircraft fire, hampering its work of reconnaissance and still more, its bombardment, are the positive results obtained, and are far from being negligible.

If this threat of a ground offensive should be lacking, it is a logical assumption to admit that the aviation arm would accomplish the greater part of its missions, at those altitudes at which the efficiency is greatest, and would accomplish them with so much greater effectiveness, the greater the impunity with which it could avail itself.

And the best proof that the action of antiaircraft arms is not negligible is given by the fact that the aviation arm is continuing with diligence, its studies, its researches, as to the possibility of flying at greater altitudes, the possibility of extending continually its limits of photographic observation, as to muffling the sound of the engine, as to long distance bombardment (telebombs) as to protecting the aircraft with armor, and concealing aircraft with artificial clouds.

### Fundamental Inventions

Great fundamental inventions are sometimes made possible by what appear at first glance to be mere accessories.

Printing is often called the most important invention in the history of civilization, yet it may properly be said that paper was a greater invention, since printing itself was quite useless without a cheap material on which to print. The ancients knew printing. They printed on metal; that is to say, they imprinted metal—coins, for instance—hot or cold, with dies. The Assyrians invented the cylinder press; but they had no paper, cheap and plentiful; nor even parchment or papyrus; so they rolled their cylinders over sheets of clay, and made brick books.

The Greeks and Romans, for their manuscript, used both parchment and papyrus. These were expensive; so expensive, indeed, that it was customary to use the sheets over and over again, covering the preceding writing with a thin, opaque, flexible coating. Some experiments appear to have been made in engraving a whole plate and burning or printing the impression on the parchment or papyrus. This would have been expensive in itself, but after all, the limiting factor was the lack of paper.

The Chinese knew printing. They even knew it, vaguely, as we know it now, with movable block types. They too, however, lacked paper; and without it printing was quite useless to them.

Paper was invented in Western Asia about the tenth century. It was kept a state monopoly of the Bagdad Caliphate, but no use was made of it for printing. As the Moors swung across Africa and into Spain in the middle ages, they brought paper with them. Early in the fourteenth century some of it fell into the hands of certain inquisitive Europeans who investigated its composition and discovered how to make it; and the first paper mill was set up at Regensburg.

The product was seized upon for comparatively cheap and large hand-copies, editions of ancient authors, for Western Europe was hungry for learning; these editions stimulated a demand for mechanical reproductions; and printing was invented simultaneously about the middle of the fifteenth century by Coster, by

Gutenberg and doubtless by a half dozen others. A hundred years seems a long time, according to our twentieth century standards of rapid progress; but considering that mankind had existed endless centuries without printing, its invention within a single century after the discovery of a cheap material for multiple reproduction is an admirable achievement.

Within fifteen years after the first press was erected, hundreds of others were set up all over Europe, and over ten thousand standard works by ancient and modern authors had been printed, including all the known classics and hundreds of editions of the Bible. In 1505 the first newspaper appeared and actually contained news from Brazil.

Just as paper, which appears to be the accessory, made printing, which appears to be the fundamental invention, really possible, so the pneumatic tire, the accessory, made the automobile really possible. We cannot imagine the wide use of the automobile as we conceive it today—a vehicle of small-unit transportation—to carry us in speed and comfort over the highways—without the pneumatic tire, which seems at first glance to be nothing but a minor part of the equipment.

It is only thirty-two years since James Dunlop, in Dublin, made the first pneumatic tire, and where before there were perhaps a dozen automobiles in the world, there now are some 15,000,000. Dunlop was not looking for something on which to build the structure of the automobile industry—he wanted something to put on his invalid mother's wheeled chair, to make the old lady more comfortable when she took the air. As an example of the frequent thoroughness of pioneers it should be stated that his original tire was substantially as we know it today—an inner-tube, and a casing with a straight bead.

The automobile had its beginning as soon as the steam engine was invented—over a hundred years before the Dunlop invention appeared. Earnest engineers struggled to adapt it to individual road transportation, but without the pneumatic tire it was not serviceable enough to withstand the legislative pressure which put it on rails. It is interesting to speculate whether the railroad would ever have come if the pneumatic tire had been invented before mechanical power.  
—*Imperial Type Metal Magazine.*

America has furnished to the world the character of Washington. And if our American institutions had done nothing else, that alone would have entitled them to the respect of mankind.  
—Daniel Webster.



# MILITARY NOTES

*furnished by*

THE MILITARY INTELLIGENCE DIVISION, G. S.

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## Argentina

TRAINING OF DOGS FOR WAR.—That Argentina as well as Japan is interested in utilizing the services of dogs for communication purposes in war is shown by a recent report that:—

Sixty-six dogs to be used for military purposes have arrived in Buenos Aires from Brussels, where they were purchased by General Maglione, of the Argentine Army, during a recent trip to Europe. The animals belong to two breeds known as Malinois and Groneandal. They are said to display particular qualities of courage and intelligence, to which is added a keen sense of smell. All the dogs have been taken to the Military School at El Palomar, where they will undergo a special course of training by a man who during the war prepared quite a number of dogs to carry messages on the battlefield and between the different lines of attack.

## China

REORGANIZATION OF FENGTIEN (MANCHURIAN) ARMY.—Following the fighting of the fall of 1924 Marshal Chang Tso-lin decided to reorganize his armies along the most modern lines using a combination of European and American systems. His purpose was two-fold, (a) to make each unit practically independent, thereby allowing for greater mobility and facility in administration, and (b) to promote many officers who had shown remarkable ability during the recent campaign by giving them added responsibility.

In December, 1924, an Army Reorganization Bureau was constituted at General Headquarters in Mukden and General Chang Hsueh-liang (the youthful son of Marshal Chang Tso-lin) was placed in direct command. As a result of three months' work of this Bureau, on March 27, 1925, a General Order was issued giving the following outline of the "Armies of the North East."

There are 16 divisions of infantry, 2 divisions of cavalry and 2 artillery brigades.

### *Infantry Division.*

Each of the 16 infantry divisions is organized as follows under the command of a major general (three gold stars on a field of gold epaulets).

(a) Two brigades each commanded by a brigadier general totaling 5400 officers and men each.

(b) Three regiments in each brigade, each regiment commanded by a colonel and totaling 1800 officers and men per regiment.

(c) Three battalions in each regiment, each battalion commanded by a major and totaling 600 officers and men per battalion.

(d) Four companies in each battalion each company commanded by a captain and totaling 150 officers and men per company.

(e) Three platoons in each company. One first lieutenant and two second lieutenants command the three platoons. There are noncommissioned officers, usually one sergeant and two corporals to every two squads, one squad totaling eight men.

#### *Auxiliary Regiment (Inf.) Units.*

Each regiment (Inf.) has attached to it:

(a) One machine-gun company of six guns and totaling 40 officers and men.

(b) One trench mortar company of six 3-inch Sutton Mortars and totaling 100 officers and men.

(c) One special battalion including pioneers, engineers, sanitary and hospital units, and replacements, 700 officers and men.

#### *Total Serength Infantry Regiment.*

It will be seen therefore that the total strength of each division of infantry is 11,640 officers and men and that the total strength of 16 divisions of infantry is 186,240 officers and men.

#### *Cavalry Division.*

Each of the two divisions of cavalry is organized as follows under the command of a major general. The total strength of each division is 3200 officers and men.

(a) Two brigades each commanded by a brigadier general totaling 1600 officers and men.

(b) Two regiments in each brigade each commanded by a colonel totaling 800 officers and men each.

(c) Four squadrons in each regiment each commanded by a major and totaling 200 officers and men each.

(d) Three troops in each company each commanded by a captain and totaling 70 officers and men each.

(e) Three platoons in each squadron each under the command of a lieutenant.

#### *Artillery Brigade.*

Each of the two artillery brigades is organized as follows under the command of a brigadier general. The total strength of each artillery brigade is 2700 officers and men and 108 field guns.

(a) Three regiments in each brigade each commanded by a colonel and totaling 900 officers and men and 36 guns.

(b) Three battalions to each regiment commanded by a major and totaling 300 officers and men and 12 guns each.

(c) Three batteries in each battalion each commanded by a captain and totaling 100 officers and men and four guns.

(d) Two sections in each battery commanded by one first lieutenant and two second lieutenants, two guns each.

#### *Engineers.*

There is one regiment of engineers under the command of a colonel and divided into five battalions each commanded by a major. There are 600 officers and men in each battalion or a total of 3000 in all.

*Recapitulation.*

16 divisions, infantry, 11,640 each .....	186,240
2 divisions, cavalry, 3,200 each .....	6,400
2 brigades, artillery, 2,700 each .....	5,400
1 regiment, engineers, .....	3,000
Total .....	201,040

**Hungary**

**MILITARY ACADEMY.**—The military school from which the Hungarian Army receives its commissioned officers of the lowest grade is the Royal Hungarian Honved Ludovica Academy.

This academy is organized similarly to the United States Military Academy, having one battalion of four companies, with a total of 500 cadets, and has a four-year system, which is also comparable to West Point. The graduating class furnishes cadet officers for all companies.

All members of the faculty and instructors are officers of the Hungarian Army. Instruction is given in practical training, military and allied sciences, chemistry, mathematics, etc., on about the same scale as the U. S. M. A.

The graduates are assigned as second lieutenants to infantry, cavalry, or field artillery. They have to obligate themselves to twenty years' service upon graduation, although they have the option of refunding to the Government the amount expended for their four years' instruction. This, however, is almost unknown, since practically every graduate enters the army.

As at present equipped, this military academy can furnish sufficient young officers, well-educated and well-disciplined, to replace all vacancies in the Hungarian Army.

**Italy**

**GENERAL STAFFS OF DEFENSE FORCES.**—Since the assumption of the portfolios of the Minister of War, Navy and Aviation, by Premier Mussolini, several changes have occurred amongst the officers holding the positions of Chief of Staff of the three services.

The new Chief of Staff, General Staff of the Army is General Badoglio with General Grazioli as Assistant Chief of Staff.

Vice Admiral Acton and Captain Cantu are, respectively, Chief and Assistant Chief of Staff of the Navy.

For aeronautics, General Piccio is Chief of Staff with Lieutenant Colonel Cassone as Assistant Chief.

The decree for the creation of a general staff for the Air Service was signed by the King on May 7th last. General Piccio was formerly general commander of the G. H. Q. Military Air Service and later Italian Air Attache at Paris. He is an Italian ace who was promoted three times during the war for exceptionally meritorious service. Recent reports from Italy are to the effect that the Ministry of Finance has approved the immediate increase of ninety million lire\* in the 1925-26 aviation budget in view of the planned reorganization of the Air Service. The present budget amounts to 449 million lire and with this new increase will total 539 million.

In presenting the bill covering the Supreme Command of the Army to the Senate, Premier Mussolini stated in part:

\* The lire is at present the equivalent of approximately 3.7 cents.

"The Bill therefore determines the activities of the Higher military authorities.

"It institutes the Chief of General Staff as the person who will provide for the organization of the land forces, for the preparation for war, and for the military subdivisioning of the territory of the State.

"Inasmuch as there must be only one man to preside over the technical military preparation, only one to draw up the general plans for war operations, the Chief of General Staff will outline for the Chiefs of Staffs of the Navy and Air Service also the general plans for the cooperation of the Air Service and Navy in attaining a unity of purpose.

"This means a return, amplified according to the increased exigencies of the times and to the experience of the World War, to the appointment of Chief of General Staff by which the Army, through the political vicissitudes of our recent history, achieved the unity of Italy and the triumph of Vittorio Veneto.

"From the Bill it is clear that the Chief of General Staff is vested with the necessary authority so that, while directly under the Ministry of War, he may develop activities of a technical character to the end of securing in the military provisions, uniformity of trend without discontinuity and without venturing on too radical and consequently dangerous changes.

"Hence, the Chief of General Staff may, if necessary, avail himself of the competence of the senior military authorities forming the advisory assembly known as the Council of the Army.

"Where questions of exceptional importance are concerned, the Chief of General Staff may consult with the present Marshals of Italy and the Grand Admiral as authorities who, because of their vast experience and personal value, can contribute efficiently to the solution of the most arduous military problems.

"The purposes of the Bill are substantially the following:

"(a) Unity of responsibility and of execution where technical provisions appertaining to the Army are concerned.

"(b) Continuity of technical trend with respect to such provisions.

"(c) Coordination of the general defensive organization of the State—the different forces retaining the necessary independence of technical preparation and of employment—and coordination of eventual war operations."

## Siam

SIAMESE ARMY MANEUVERS.—"Elaborate arrangements were made by the military authorities for the Army Maneuvers held this year near Ayudhya from March 10th to the 18th.

"Approximately 20,000 troops were employed in the maneuvers, comprising four divisions of the army, all coming from northern Siam. The men of these divisions were strong and healthy, and those assigned to camp duty were well trained in camp sanitation and the bivouacs were clean and orderly. All of the enlisted men were barefoot, and their feet were tough and thick, and rough ground had no effect on them.

"The field of operation consisted of rough paddy land and swampy marshes extremely difficult to pass.

"The infantry of the Siamese Army is equipped with the Japanese Arisaka rifle (1901) 8-mm. caliber.

"The artillery possessed by the Siamese Army is the type French 75-mm. Japanese make with somewhat shorter barrel than those used by the French. They have twelve batteries of four guns each.

"There were thirty-five planes taking part in the maneuvers.

"They have an excellent corps of aviators very well trained, and it is evident Siam bases her defense on aviation.

"The maneuvers lasted seven days. The soldiers stood their test wonderfully. Their hours of duty being from 5 a. m. to 8 p. m. each day.

"The army is trained entirely by Siamese, no foreign instructors being employed. Many of the officers have received military training in Europe."

## Spain

**MILITARY DECORATIONS.**—New regulations have recently been promulgated in Madrid covering the granting of decorations to members of the Army and Navy.

The cross of "Maria Cristina" which was discontinued by the law dated June 29, 1919, is reinstated. A new decoration "Medalla Militar" (Military Medal) bicolor, is established to reward meritorious services in connection with military operations, rendered without actual combat against the enemy.

A list of military decorations now existing, follows:

<i>Name of Decoration</i>	<i>When Created</i>	<i>To Whom Awarded</i>	<i>Character of Services Justifying Award</i>	<i>Extra Pay</i>
Cross of Military Merit, distinctive color, red.	December 30, 1889	Officers, enlisted, and civilians cooperating with military forces.	Individual merit directly influencing the success of a military operation.	No pay for officers. Enlisted may have a pension from ptas.* 12.50 to ptas. 25-a month, during five years, or for life.
Cross of "Maria Cristina."	January 30, 1890. Discontinued June 29, 1919. Reinstated Mar. 16, 1925.	Officers and Enlisted.	Very distinguished individual merit. Conditions similar to those required for promotion.	Pension ranging from ptas. 750.00 to 3,750 ptas. a year for officers. From 500 to 675 ptas. for enlisted. Duration of pension, five years.
Military Medal	June 29, 1918	Officers and Enlisted.	Remarkable deeds facing the enemy.	No pension.
Cross of "San Fernando"	June 29, 1918	Officers and Enlisted.	Very exceptional heroic deeds or feats.	<i>With laurels:</i> from 1500 to 7500 ptas. a year for officers. From 1000 to 1250 ptas. for enlisted. <i>Plain:</i> from 300 to 1500 ptas. a year for officers. From 200 to 250 for enlisted.
Medal of suffering for the Country.	July 7, 1921	Officers and Enlisted.	Awarded to those wounded and captured in meritorious instances.	That of war prisoners, without pension; for wounded: officers, from 500 to 10,000.
Cross of Military Merit, bicolor.	July 7, 1921	Officers and Enlisted.	Meritorious war services, not while in active combat.	No pension.

\* The peseta is at present the equivalent of approximately 14.50 cents.

Besides the foregoing crosses and medals, there exist, (a), the award of citation of "distinguished" in the General Order of the Army, in case of services which justify it (to be entered on the "record of service" or "efficiency report"); and (b), promotion to the next higher grade for war merit. Instead of promotion to the higher grade, the Cross of "Maria Cristina" or that of Military Merit, with red distinctive color, may be awarded.

Collective awards may be granted to military Units.

Commanding Generals are authorized to grant all awards for enlisted personnel including promotion up to a warrant officer on the field of action, without previous proposal.

# COAST ARTILLERY BOARD NOTES

*Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration.*—R. S. ABERNETHY, Colonel, C. A. C., President Coast Artillery Board.

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## New Projects Initiated During the Month of June

**Project No. 355, Allowance of Canvas Paulins.**—A letter from the Quartermaster General, referred by the Chief of Coast Artillery for remark and recommendation of the Coast Artillery Board with a view to standardization of sizes. The Board has requested the views of the Commanding Officers of the 12th, 61st, 51st and 52d Coast Artillery on the subject.

**Project No. 356, Illuminating Projectiles for Coast Artillery (Star Shells).**—This project was referred to the Board for study by the Chief of Coast Artillery. The Board recommended test of 6" star shells in harbor defense guns, and 3" star shells by Antiaircraft Artillery.

**Project No. 357, Astronomic Theodolite for Artillery.**—This is a device designed by Captain de Kraft-Helmbacker of the French Army for regulating artillery fire using a heavenly body as aiming point. After study of the device, the Board expressed the opinion that it gave no promise of practical value in connection with position finding and fire control for Coast Artillery.

**Project No. 359, Modification of Gun Deflection Board, Model 1905.**—This is a study by the Coast Artillery Board of a modified gun deflection board. This board was modified by the Battery Commander, Battery Warren, Fort Amador. The purpose of the modification is to extend the function of the deflection board so as to include azimuth difference corrections in indirect laying and arbitrary direction corrections in both direct and indirect laying.

**Project No. 360, Test of Radio Equipment for D. B. Boats.**—This is a test of a Type SCR-133 radio telegraph and telephone set to determine its suitability for use on distribution box boats.

**Project No. 361, Mechanical Data Computer for Sound Ranging.**—Captain J. W. Barker, C. A. C., and Captain P. D. Terry, C. A. C., while pursuing a course of instruction at Massachusetts Institute of Technology, made a study and prepared a thesis for their Master of Science degree on "The Application of Hyperbolic Functions to Sound Ranging." As a result of this investigation the above named officers conceived the idea of developing a mechanical computer for sound ranging. The Board has recommended that Captain Barker be requested to continue his studies along this line and to complete the development of a working model and that when completed the model be submitted to the Coast Artillery Board for test.

**Project No. 362, Fire Control Communications System for Fort Storey.**

—The Coast Artillery Board, after study of the present contemplated system, recommended certain modifications, and also recommended that a searchlight project be instituted.

**Project No. 363, Test of SCR-136 Radio Set.**—Now undergoing test by the Coast Artillery Board.

**Project No. 364, Lubrication Chart for 5-Ton Artillery Tractor.**—

Referred to Commanding Officer 51st Coast Artillery for remark and recommendation.

**Project No. 365, Wearing of Personal Equipment.**—A proposal to change the wearing of the canteen from the right to the left buttock in order to balance the weight of the pistol which is worn on the right hip. Under study.

## Completed Projects

**Project No. 222, Time Range and Azimuth Interpolating Device.**—**I—HISTORY.**

1. This project originated with the Coast Artillery Board, the object being to develop a more satisfactory solution for determining the time range (elevation) and azimuth relation than is given by the time range and azimuth boards used either in the plotting room or at the emplacement. The following is quoted from Project No. 220, Seacoast Artillery Firing:—

“22. *Time Range (Elevation) and Time Azimuth Devices:* Prediction oftener than once in 30 seconds cannot be accomplished on manual plotting boards at present in use or adopted. However, it is desirable to provide a means for subdividing the range and azimuth predictions in order that accurate firing data may be available at the guns whenever they are ready to be fired. No thoroughly satisfactory means for subdividing these predictions has been prescribed. For fixed guns the time range relation board has been used for the interpolation of firing ranges together with “creeping” on the range drum of the gun. There is no serious objection to creeping, but the operations between procurement of a corrected range to the setforward point and the receipt of fire data by the range setters at the guns always have been cumbersome. It has been customary to plot the time range and time azimuth curve on the time range board and time azimuth board and then interpolate for the intermediate intervals. It is believed that a more satisfactory means for handling the time range and time azimuth relation can be devised and the Coast Artillery Board is studying this question in Coast Artillery Board Project No. 222, “Time Range and Time Azimuth Interpolating Devices.” The Time Range and Time Azimuth Spirals described in Coast Artillery Board Project No. 75, “Fire Control System for 155-mm. G. F. P. Guns,” and the use of proportional dividers in connection with the elevation board (Percentage Corrector) and the Deflection Board as described in Coast Artillery Board Project No. 117, “Fire Control Method for Mortars” are both satisfactory. It is believed, however, that it may be feasible to develop means whereby the time range relation may be taken directly from the Percentage Corrector (Elevation Board) and the time azimuth relation directly from the deflection Board.”

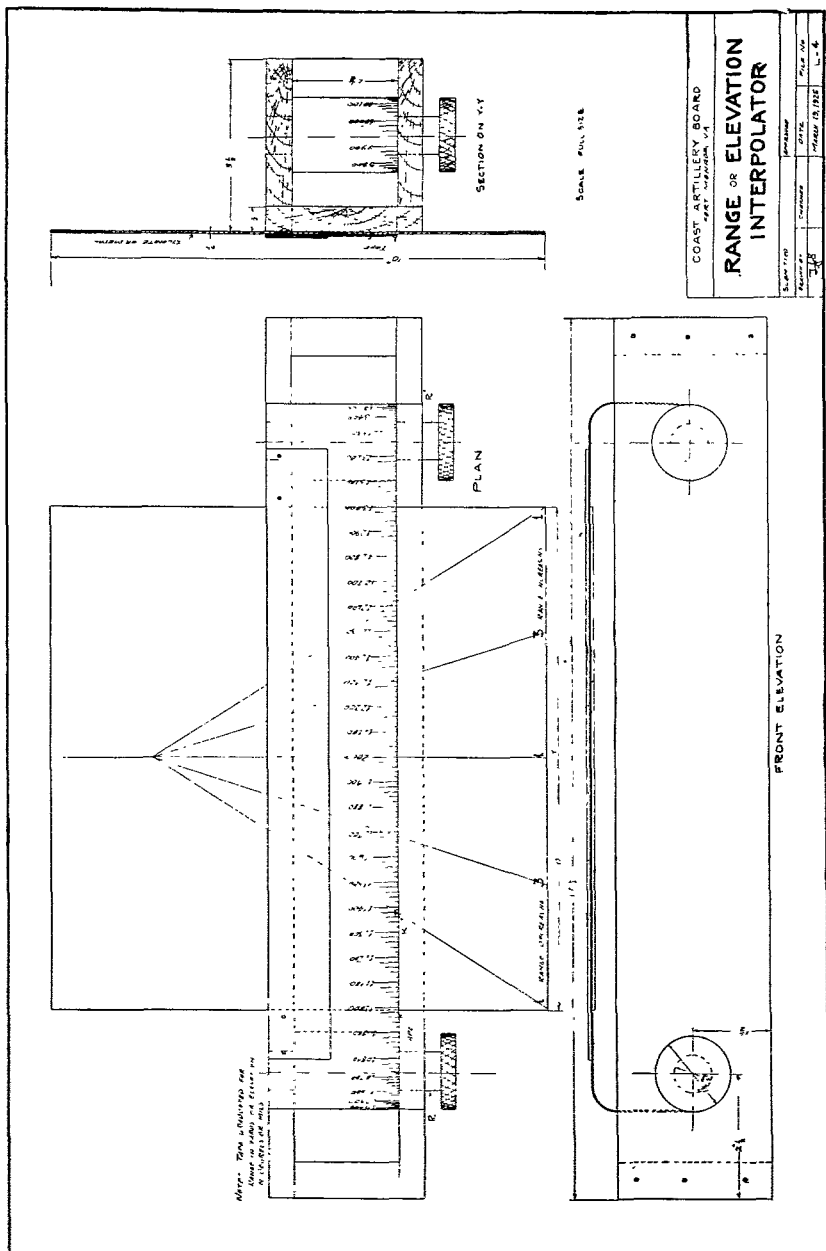


Fig. 1



## II—DISCUSSION.

2. The Coast Artillery Board incorporated a time azimuth relation device in the deflection boards reported on in Projects No. 316 and 87. These devices were given a thorough service test and proved very satisfactory so that the Coast Artillery Board believes the time azimuth relation problem is settled in connection with the proposed universal deflection board.

3. It was desired to apply a device similar to the splitter on the deflection board to the percentage corrector for determining interpolated or extrapolated ranges and elevations, but this could not be done quite as simply as on the deflection board. The reason for this is that for targets moving at 1200 yards per minute a splitter in connection with the logarithmic scale on the percentage corrector could not meet the conditions of maximum travel during a predicting interval. After considerable study it was decided that a simple small device carrying a tape on rollers and provided with a splitter similar to that on the deflection board (C A. B. Project No. 87) could be attached to the percentage corrector for determining the time range or elevation relation. The Coast Artillery Board devised such a device which is called the "Range or Elevation Interpolator." This device can be attached to the percentage corrector *and necessitates no changes in that device* as the percentage corrector has a slot on the side through which the xylonite or metal splitter of the range interpolator may pass. This slot is shown at "A" on Coast Artillery Board Drawing C-82-A attached hereto.

## III—DESCRIPTION.

4. The range or elevation interpolator consists of a wooden frame having rollers R and R' which carry a cloth blue-print range or elevation scale, as shown in Figure 1. The top of the interpolator is made into a guide for the xylonite, metal or pasteboard interpolating sheet and carries on it the reading lines marked 1 and 3. The xylonite sheet is free to move in or out and the cloth tape moves over the xylonite sheet. For use in making interpolated and extrapolated readings from the tape a small rider K is used. When the interpolator is manufactured at a post this rider may be an ordinary metal paper clip.

5. The cloth tapes are to be furnished by the Coast Artillery Board, the selection and arrangement of suitable scales being dependent upon particular armament with which the interpolator is to be used.

6. The splitter shown in Figure 1 is made of xylonite and has interpolating lines for 15 second intervals on one side. In arsenal construction it is believed the splitter should be of metal and have interpolating lines on one side as shown in Figure 1, but the reverse side to be covered with some material which would permit a battery commander to draw on it interpolating lines for any desired intervals as 5 or 10 seconds.

7. *Operation.*

a. The interpolator should be attached to the percentage corrector on the side opposite the correction scales.

b. The operator of the interpolator wears a headset and has direct telephone communication with the guns.

c. On the basis of 15 second intervals it will be found convenient to arrange the Time Interval system to give 3 taps of the bell each 30 seconds and 1 tap at the intermediate of 15 second interval.

d. The reading lines on the interpolator are numbered 1 and 3 and the side of the interpolator for use in determining proper interpolated ranges is indicated

by the notation "range decreasing" and "range increasing." Data read under the central line is sent out as soon as possible under 1 bell and are good for firing on 3 bells; data read under proper line 3 are sent out as soon as possible after 3 bells and are good for firing on 1 bell.

*e.* On 1 bell or as soon as available after 1 bell the interpolator operator reads in his telephone the data indicated by the read pointer of the percentage corrector. He moves the interpolator tape so the data indicated by the read pointer of the percentage corrector are indicated on the interpolator by the central line 1 and places the rider K on the tape at this point. Suppose the reading is 9600. On the next "one" bell or as soon as possible thereafter, the interpolator operator reads into his telephone the new data indicated by the read pointer of the percentage corrector and moves the interpolating tape to indicate the new data under the central line "1." Suppose the reading is 9200. The rider K will now have been displaced to the right. The xylonite sheet is moved in or out until the diagonal line 1 intersects the index of the rider, and the rider K is then moved back to the central line 1. The diagonal line 3 for increasing range indicates the proper data to be telephoned the guns on 3 bells and is good for firing on 1 bell. These operations are continued, the rider K always being brought back to the central line as soon as the setting of the diagonal line on the xylonite sheet has been made.

*f.* Should the operator of the percentage corrector fail to furnish any particular corrected range or elevation after the second, approximate corrected ranges or elevations may be predicted on the interpolator by keeping the xylonite sheet stationary moving the tape to the right or left as the case may be until the rider K again coincides with the proper diagonal line 1, reading predicted corrected ranges or elevations under central line 1 and proper diagonal line 3 and returning K to its position in coincidence with central line 1.

*g.* Should it be desired to lay the gun in elevation or range for times between the 15 and 30 second data, resort may be had to "creeping" on the range drum or the operator of the interpolator may be taught to estimate readings synchronizing them with a stop watch so as to send out practically continuous ranges or elevations. If desired, reading lines for 5 or 10 second intervals may be placed on the reverse side of the xylonite sheet and interpolations made as described above. (See paragraph 6).

8. *a.* Percentage correctors are being manufactured at Frankford Arsenal. It is considered very desirable to have five range or elevation interpolators made at the arsenal and attached to the percentage correctors so that both devices can be given conclusive service tests.

*b.* A model of the proposed range or elevation interpolator is available for shipment by mail to Frankford Arsenal. If arsenal construction closely follows the model, except as suggested in paragraph 6 above, it is believed the device will be quite satisfactory for service tests and will be inexpensive. It is understood that the percentage corrector costs approximately \$40.00 each in lots of five and since the range interpolator is of much simpler construction the cost should be much less than that of the percentage corrector.

#### IV—CONCLUSIONS.

9. *a.* That the time azimuth relation device included in the deflection board proposed in C. A. B. Project No. 87 is a satisfactory solution of the time azimuth relation problem in connection with present fire control devices.

*b.* That the range or elevation interpolator described above offers a sufficiently promising solution of the time range relation problem to justify the manu-

facture of five such devices for service tests in connection with the five percentage correctors now being manufactured at Frankford Arsenal.

V—RECOMMENDATIONS.

10. *a.* That five range or elevation interpolators similar to the one shown in Figure 1, but subject to the suggestion made in paragraph 6 above, be manufactured and attached to the percentage correctors now being made at Frankford Arsenal.

*b.* That authority be granted to mail a model of the time range elevation interpolating device to Frankford Arsenal for the consideration of that arsenal.

*c.* That the Coast Artillery Board be authorized to furnish drawings and tapes for the Range or Elevation Interpolator whenever drawings of the percentage corrector are furnished organizations, and that Regular Army Organizations be authorized to use the Range or Elevation Interpolator.

VI—ACTION BY THE CHIEF OF COAST ARTILLERY.

*First Indorsement*

War Department, O. C. C. A., April 7, 1925.—To Chief of Ordnance:

1. The recommendations of the Coast Artillery Board contained in paragraphs 10-*b* and 10-*c* of the enclosed Project No. 222 are concurred in. The necessary steps will be taken by this office to put these recommendations into effect.

2. With reference to the recommendation contained in paragraph 10-*a* of the above project, information is desired as to the cost of the proposed device and the feasibility of adding this device to the five percentage correctors now under manufacture.

Strategy's object is to bring every available man to the battlefield, and place the army in a most favorable position to strike a deadly blow. The aim of tactics is to maneuver and handle the troops in the battle itself.—*History of Tactics*, by A. F. Becke.

## BOOK REVIEWS

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*A Study of War.* By Admiral Sir Reginald Custance. Houghton, Mifflin Co., Boston. 6" x 9". 214 pp. \$3.50.

The object of this work, as stated in the preface, is "to remove the vagueness and ambiguity in which the theory of war is usually enveloped, and by so doing to explain the cause of the difference between the political and military points of view, and in some degree to reconcile them."

In view of the constant conflict and confusion of political and military aims in wars, one may incline to the belief that something very difficult is undertaken, but one needs read only a few chapters to become confident the aim will be realized.

The author points out that in considering the national aim in war he has substituted the British doctrine of the "will to security" for the German "will to power." Accordingly the reciprocal, national or political object in war is defined as: "Security for every questioned right, every threatened interest, and the State itself including its political system and territory."

In a later chapter it is stated: that "the military aim of each side is to destroy in battle, or to neutralize the action of the opposing armed force while sparing its own"; that "these are the primary military aims"; and that "as a contributing or secondary aim, during the interval \* \* \* before the achievement of primary aims, each side may seek to weaken the armed force of its opponent, and to strengthen its own by impairing or increasing as the case may be the material resources and moral support upon which those forces depend." From this is derived the definition of the *whole* military aim of each side, i. e.: "To destroy in battle, or to neutralize, and to weaken the opposing armed force, including its directing will, while sparing and strengthening its own."

But a link is missing from the chain, in the failure to point out specifically that the national aim can never be realized except in consequence of the accomplishment of the military aim and that attempts to realize the political aim independently of the military aim must necessarily fail. It is true this is implied and may be deduced from the historical illustrations, but in the opinion of the reviewer, not even clear comprehension of the respective aims is more important to the statesman or the fighting man than definite recognition of this relation.

The author proceeds by illustration to show that the military aim may be accomplished by the destruction of the hostile armed force in battle or by its neutralization through "either threatening battle or evading battle or postponing battle."

Operations are briefly and clearly described and aptly chosen to illustrate the principles. In the course of his study the writer deduces that "to disarm an enemy who possesses both a navy and an army, two battles must be fought, the

one at sea, the other on land" and that "a navy alone is not a threat to the independence of a Continental State which possesses an army even if the State has no navy but that an army alone is such a threat to an island state whether that state possesses a navy or not." He fails to follow out his deduction to its conclusion, that, as a rule, final decision in a great war is obtained by the destruction of the hostile land force. It seems a characteristic of English writers to ignore the fact that Germany very nearly won the World War without defeating the British Navy.

The chapter on the relations between the Navy, Army and "Aery" will be found particularly interesting in its bearing on the present agitation for a separate air force for the United States. The writer concludes that air superiority will not be decisive, and that the air force should form integral parts of the Army and Navy.

The relations between the national object and military aim, in the view of Admiral Custance "are covered by the word *strategy* which may be defined thus: It is the province of strategy to attain the national object through the complete, partial or threatened achievement of the military aim under the existing political, economic and military conditions."

This definition is interesting but will not fit in with the ordinary conception of strategy as the adaptation of tactical operations to the attainment of the military aim. For example, Grant's strategy in 1865 was directed to the destruction of the Confederate armies and did not concern itself with national or political objects.

The reviewer does not agree with the *London Times* that this is a "notable contribution to naval literature" but believes this text is a notable study of war on land, on sea, and in the air, and the lessons taught invaluable to sailor, soldier, or statesman.—R. S. A.

*Current Problems in Citizenship.* By W. B. Munroe. The MacMillan Co., N. Y., 1924. 5¼"x 7½". 541 pp. \$1.80.

This book was written by the Professor of Municipal Government in Harvard University. He has reviewed his work in the preface as follows: "This book endeavors to explain, in concise form and simple language, some of the current problems with which every well-informed American citizen ought to be familiar. The term current problems is used in a broad sense, however, and the discussions are by no means restricted to topics which figure in the headlines of the daily newspapers. The latter are, for the most part, only the outcroppings of forces which are at work beneath the surface of our political, social, and economic life. Many problems of citizenship receive very little public discussion; yet they remain current over a long period of years and make their various phases manifest, one after another. The real nature of a current problem is frequently related to its origin, and for this origin we must sometimes go a long way back. The social studies cannot be entirely dissociated from history; their relations are too intimate.

"The author has tried to present problems, not to solve them. No problem of democracy, worthy of the name, can be solved by merely applying a rule or principle. On the other hand this book devotes considerable attention to the various solutions which have been proposed from all quarters and examines the merits of these proposals—when they have any merits. The idea, in short, is to let the reader form his own opinions but to afford him such guidance that he will be able to do it intelligently.

"At the end of each problem there is a reference to some more extensive discussion of the matter, or to a source from which additional facts may be obtained. It has not been deemed necessary to cumber these long bibliographies which can be found in any of the regular textbooks. It has been deemed essential to insert lists of questions. Every problem has a question, indeed a series of questions, as will readily appear from the marginal notes."

Current Problems in Citizenship satisfies the above in a most instructive manner. Its conciseness enables a wide field to be covered in two chapters which have been grouped under the three headings: His Environment, Problems in the Organization and Work of Government, Problems relating to the Civic Activities—Economic, Social, and International. H. B. H.

*Our Capital on the Potomac.* By Helen Nicolay, The Century Co., New York, 1924. 6¼"x9¼". 544 pp. with index. Profusely illustrated. Price \$5.00.

In this day of a rapidly increasing literature on places, it is not easy to find a volume that so distinctly is neither a guide book nor a sop to vanity. Miss Nicolay has achieved a difficult task, she has written a most interesting history of "Our Capital on the Potomac." The author already is known to us by her "Personal Traits of Abraham Lincoln" and "Our Nation in the Building." She is well qualified by association and study to treat of this subject. From events leading to the selection of the site of the District, the story leads us through the life of the city down to the period of World War demobilization. It is a story of life, not merely of a place. The place forms a background and is well cared for in the tales of living events. It is the latter that compel attention and that have made this such an entertaining work. The establishment and growth of the city are depicted amid the accounts of the doings of the interesting people inhabiting it. Intimate views of the presidents and other national characters are portrayed. In short, Miss Nicolay has contributed a history of the development of Washington that is full of information, a history that is of absorbing interest, and altogether a most readable book.—C. D. Y. O.

*Bird Islands of Peru.* By Robert Cushman Murphy. G. P. Putnam's Sons, New York, 1925. 6½"x9½". XX + 362 pp. Illustrated. Price \$5.00.

This book is an account of Dr. Murphy's expedition to the islands of the Peruvian coast from September, 1919, to February, 1920, under the auspices of the Brooklyn Museum. One of the objects of the expedition was to investigate the oceanic conditions responsible for the peculiar zoological conditions existing in that little known part of the world. This book explains, in popular language, the profound effect which the up-welling cold waters of the Humboldt Current have upon the climate of coastal Peru and upon the kind and quantity of fish which frequent the locality in such vast schools. Where there are plenty of fish there one expects to find an abundance of sea-fowl and this is certainly the case among the islets which fringe the coast of Peru. The myriads of gannets and other sea birds (many of which seem to be out of their usual habitat) that subsist on the fish of the Humboldt Current have rendered possible the great guano industry.

The ups and downs of this industry are treated in some thoroughly reliable sources, as are also the present day methods of exploitation used by the Peruvian government. Probably the most interesting parts of the book to the casual reader are the descriptions and illustrations of the birds.

we have one an idea of the sheer *numbers* of these guano-birds which command solidly cover areas of several square miles of the barren islands, so that, from a distance, seem to have changed complexion from a gleam to a sombre black.

The formation of the book is excellent and the numerous illustrations, while so contiguous to their related printed matter, are well selected.—P. D. B.

*For Science and the Future.* By J. B. S. Haldane. E. P. Dutton and Company, New York, 1924. 93 pp. Price \$1.00.

H. G. Wells, that versatile Englishman, in 1902 wrote in a book called "Anticipation" that in 1950 there would be heavier than air flying machines capable of great use in war. Mr. Haldane, a scientist at Cambridge University, is the author of "Daedalus or Science and the Future." He promises in the beginning to make no prophesies rather than this one.

The author states: "It is a fairly safe prophesy that in fifty years light will be a fiftieth of its present price and there will be no more night in our day. I do not think waterpower a probable substitute for coal and oil. I think four hundred years hence the power question in England may be somewhat as follows: The country will be covered with rows of metallic mills working electric motors which in their turn supply current at a very high voltage to great electric mains. At suitable distances, there will be great power stations where during windy weather the surplus power will be used for the electrolytic decomposition of water into oxygen and hydrogen."

He believes the future will see the utilization of low grade iron ores; the production of aluminum from clay which contains up to 24 per cent of that metal; the use of acid sodium phosphate as a stimulant which does not have the after-effects like those of alcohol; and the preparation of synthetic foods which will mean that agriculture will become a luxury.

These and many other prophesies make the book of interest to those who try to pierce the veil of the future.—W. W. I.

*The History of the United States Army.* By Major Wm. D. Ganoe. D. Appleton and Company, New York, 1924. 1 Volume, 609 pp., illustrated. \$5.00.

History is "a systematic record of past events, especially of those in which man has taken part." And this is the first history of the United States Army which has been most important in the development of our country. This book gives chronologically the life of the United States Army; showing wherein progress was made and wherein there was lack of progress and even retrogression. The causes for success or failure of the Army throughout our existence as a nation are carefully analyzed and the conclusion is reached that the condition of the Army was greatly predicated on the intelligent interest manifested by the people through their representatives in Congress. Other influencing considerations, such as political influences in conduct of operations, are well covered.

It goes into the tactical and strategical details of campaigns except to the advantages of training and good organization as opposed to the incident to the untrained and poorly organized troops.

Chapter headings give a very good idea of its contents, thus: Drab Beginnings (1775-1776); The Army Learns to Walk and Run (1776-1777); The Army Discovers the Importance of Discipline and Success (1778-1781); The Army Flung Aside (1781-1812); The Army in Name (1812-1820); The Army Blazes the Trail (1821-1844);

The Army Wins and Widens the Boundaries (1845-1859); The Army Divides and Multiplies (1860-1865); The Army's Dark Ages (1865-1880); The Army's Renaissance, First Phase (1881-1896), Second Phase (1899-1916); Epilogue (1917-1923).

The book is a valuable source of information particularly as it contains many facts which have not been conveniently presented heretofore. Its arrangement is such that the activities and condition of the Army in any period can be readily ascertained. It also is useful in following the history of a particular organization.

It contains much that should be a part of every American's education and especially of those who are concerned with the organization, training and operations of any part of the Army.—C. F. M.

*Radio for Everybody.* By A. C. Lescarbourea. Scientific American Publishing Co., N. Y., 1924. 5"x7½". 358 pp. Cloth. Price \$1.50.

This book contains the very latest in the theory and practice of radio communication expressed in a clear and interesting manner. It is full of practical and helpful information for the layman who desires the essentials with a minimum of theory and a total absence of mathematics. The treatment of radio principles is hardly elementary enough for the beginner, who knows nothing of electricity or radio, but even he can find much of interest. It will be of great benefit to the average radio devotee who is eager to learn more about his set and other sets. It gives a brief history of broadcasting and the work at the studio; covers the underlying principles of all basic receiving sets and the modifications as sold on the market today, including the neutrodyne, superdyne, super-heterodyne and the rest of the "dyne" family; tells how to build your own set and how to buy a set; and covers vacuum tubes, radio and audio amplification, loud speakers, regeneration, static, and full description of parts. Also contains a dictionary of the most common terms employed in every-day radio work.

The book is profusely illustrated throughout with well selected drawings and pictures which greatly simplify the explanations.—E. R. C.

*Head Hunters of the Amazon.* By F. W. Up de Graff, with foreword by Kermit Roosevelt. Duffield and Co., New York. 337 pp. with illustrations. \$5.00.

A seven year's Odyssey. Mr. Up de Graff began his wanderings in 1894 and concluded them in 1901. During the interim he crossed the continent of South America and explored the upper reaches of some of the tributaries of the Amazon. This was practically unknown land, and his experiences there are indicative of the suffering man will undergo in his search for adventure or gold. Probably his is the only white party to participate in a head hunt and the gruesome rites subsequent thereto. He met every form of beast, reptile or pest in South America. He records anacondas of lengths unadmitted by other explorers and scientists, and thereon hangs a seemingly unending dispute, as mentioned by Mr. Roosevelt in his foreword. Mr. Up de Graff modestly disclaims any literary or scientific ability, yet, to the reader, he fails completely to live up to his disclaimer. Interesting alike to the scientific or adventurous mind, the history is as readable as a novel. The easy style of expression, the sense of humor and the thrill of the adventures carry one through page after page. Mr. Up de Graff has a most pleasing personality which he carries to you in every paragraph of his narration.—B. F. H.